The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

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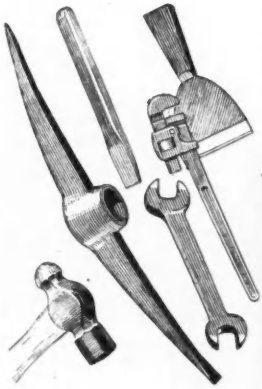

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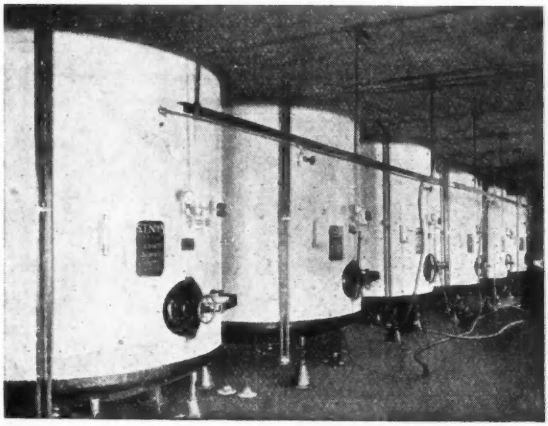

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Nitric Acid—and Some Reactions

NITRIC acid is one of the oldest and most useful of chemical substances. It is used not as an end in itself, but as an essential reagent in the manufacture of many other substances that are of value in war and in peace. This is worth emphasising in the light of some reflections that must inevitably follow Mr. Manning's recent paper to the combined chemical engineering societies at Bristol on the production of this acid in its concentrated form. Dyestuffs and intermediates, cellulose derivatives and explosives, are all instances of chemical industry wherein this acid is important.

Nitric acid is of no recent discovery, being known since the time of Geber in the 8th century, and we know that in 1225 it was prepared by distilling clay with saltpetre. Thirty years ago it was made by distilling sodium nitrate with sulphuric acid, yielding nitre cake as the residue—a method not so very different from that of a thousand years ago. The distillation was once generally carried out in glass retorts, but by the time of which we speak the glass vessels had been largely replaced by cast iron. The distilled acid was condensed originally in earthenware air-cooled receivers (Woulfe's bottles), and it does not appear to have been till the opening years of this present century that water-cooled plant was introduced for the purpose, stoneware cooling coils being used that were first made by Doulton and Watts of Lambeth. We led in technical development at this stage. So far as our recollection goes the acid so produced was about 70 per cent. strength. Many methods were used for concentration of nitric acid, which generally resolved themselves into distillation of the acid with sulphuric acid or some other substance having a greater affinity for water. The enormous quantity of nitric acid required during the last war for the production of explosives was made by this distillation process from Chile saltpetre, which had to be imported for the purpose.

The oxidation of atmospheric nitrogen was in process of development, as everyone knows, during the early years of this century, and, when—again as everyone knows—the synthetic ammonia process was successfully established, the way was opened to a new method for the manufacture of nitric acid, namely, by the oxidation of ammonia. This was obviously a process of considerable interest to this country. It was much less

On Other Pages

"messy" than the distillation process, and did not require shipping to bring in nitre from abroad. Mr. Manning tells us that nitric acid is produced at the present time mainly from the combustion of ammonia by air or oxygen in processes which result in the production of acid of 50-60 per cent. concentration. Before the acid can be used in nitration processes it must be concentrated to 98-99.5 per cent. This is effected in two ways, one being a modernised version of the old process of distillation in the presence of dehydrating agents, and the other an entirely new process involving the treatment of a mixture of dilute nitric acid and nitrogen tetroxide by oxygen under high pressure.

A passage in Mr. Manning's paper provides material for some pertinent questions. He says: "The stimulus of the 1914-1918 war, which was felt so much by many branches of chemical industry, gave rise to a considerable impetus in the design and manufacture of all types of plant for the production of nitric acid and its concentration. This stimulus was felt until the early 1920's and led to a great deal of investigation and research, resulting in the publication of many papers and patents connected with this subject. From this time developments in this country moved but slowly, if at all, but on the Continent and in the United States it continued almost without interruption. With the worsening of the international situation leading to the outbreak of the present war, interest in this country in the processing of nitric acid revived, but such was the lead secured by other countries in the intervening years that we found ourselves in the position of having to rely in many cases on foreign developments for the most advanced types of plant."

There is something sadly wrong with our chemical industry or with our chemical plant industry for such a state of things to occur. How is it that in so vital a matter as the manufacture of nitric acid by a process which did not involve seaborne transport we allowed ourselves to be faced at the outbreak of war with insufficient information and with no modern concentration plant of the second type?

Without further comment beyond asking whether this state of affairs should be allowed to continue after the war, we conclude by quoting another passage from Mr. Manning's paper: "Plants for production of concentrated nitric acid were before the war supplied by Germany to most European countries and to Japan. If the supremacy in export of chemical plant which Germany enjoyed before the war is to be challenged, it seems essential that encouragement should be given to the chemical plant manufacturers to develop further plants of the type described above. Such development is naturally expensive and demands the financial co-operation of the industry, but it must be remembered that this is amply repaid not only by later profits but by the national prestige which accrues."

NOTES AND COMMENTS

I.C.S. Apprenticeship Scheme

GOOD progress is reported by the Imperial College Union on the Vacation Apprenticeship Scheme during the past academic year. The scheme has enabled students of the Imperial College of Science and Technology to gain practical experience by working for a period with a firm, or a public utility concern. During the past year the number of students registered for this training rose from 181 to 340, while the number of weeks of work for all students was, at 1897, nearly double the 1941 total, while 172 firms came into the scheme, as compared with 124 in 1941. Apart from its great value to the students, industrial concerns have been quick to realise the benefit to themselves of introducing the student to the work he will later have to undertake. These firms have paid students sums of money ranging from £4 to £50 for services rendered. At the same time consistently satisfactory reports have been sent back by the firms about the young people "lent" to them. One company wrote, for instance, that they would like the opportunity of considering the second-year chemical student, who was with them for a short time, for a permanent job when he had completed his degree course. Similar offers were made by two other concerns

"N_2O" by Neil Nettleton

SCIENCE IN THE GOVERNMENT?

Whitehall Porter: You're welcome, Sir, but *only in an advisory capacity!*

to a third-year chemical engineering student and a second-year chemistry student. Among the many firms thanked by the Imperial College Union for co-operation is a large number of chemical and metallurgical companies.

Europe's Chemicals: A German View

THE German technical Press has been somewhat preoccupied recently with an attempt to show that, in many branches of chemical industry, productive capacity has rapidly advanced so that Europe as a whole will soon be "free of the Anglo-Saxon yoke." This refers more specifically to certain foodstuffs and raw materials of which the British Empire is supposed to have a monopoly; and it is evidently implied that, under the beneficent rule and skilled technical guidance of Germany, the countries of Europe—already making remarkable progress under that rule—will become quite independent both of Great Britain and of the U.S.A. in all important chemical products, more especially raw materials which are to be replaced by synthetics or "Ersatz." Even a superficial examination, however, of these fantastic claims shows that they are quite illusory. In the *Chemiker Zeitung*, for example, where they are presented at some length, much more space is devoted to Sweden and Spain than to German-occupied territory; and it is clearly shown that real progress, if any, has been made in chemical industry only in those countries. This is, in fact, confirmed from other non-German and much more reliable sources, and some account of developments in Spain and Sweden has been given in our pages.

"Collaboration" on the Continent

IN both Sweden and Spain, of course, chemical workers necessarily labour under many war-time difficulties, but

these are insignificant when compared with those of German-dominated Europe. Bereft of most of their skilled workers, robbed of food and raw material, their transport systems ruined or wholly occupied by their taskmasters, and their technical leaders and research workers either exiled or dead, these unhappy countries can make no real progress in any direction; certainly not in such complex and highly skilled and organised activities as the chemical industries, even under the stinging whip of Germany's urgent demands for more supplies of everything. There has, no doubt, been much talk of collaboration between German chemical firms, like the I.G., and those of the occupied countries; but this is mostly on paper, and practical results are almost infinitesimal. In France, for instance, a large new company has been formed for the manufacture of liquid fuel by distillation of lignite, financed by the Banque de Paris, but it is expected that it will take at least three years to fit up the factory to work the Fischer-Tropsch process.

In the Satellite States

LITTLE is said nowadays in the German technical Press about Italy, despite her great and progressive chemical industry before the war. Some pre-war index figures are given to show the expansion during 1935-39, and reference is made to collaboration between the I.G. and the Pirelli company in the matter of synthetic rubber, also dating from before the war. In Belgium, Hungary, and South-Eastern Europe, the principal claims to war-time progress appear to be based on desperate attempts to establish indigenous industries in order to replace imports no longer available from Germany, especially in such lines as fertilisers, and plant sprays. There is little doubt that, after the war, Germany will endeavour to regain her dominating position as chief supplier of chemicals in Europe—if she can—and these new industries will collapse; but no doubt the Allies will have something to say about this when dictating terms of peace. Even where, as in France, quite a substantial production of plant-spraying materials such as calcium arsenate has apparently been established—to the extent of 20,000 tons per annum—this is of little use to the French growers, for they are unable to obtain the necessary spraying equipment. It has been sent to Germany.

Liquid Purification of Gas

ALTHOUGH little can be said of industrial research in war-time, it goes on with all the energy that can be mustered by the laboratory workers. Compilers of the annual report of the Gas Research Board have been well aware of their limitations with regard to publicity, but sufficient is shown in the document they have produced, surprisingly interesting in the circumstances, to indicate the extent of progress. The report records the appointment of Professor M. G. Evans, D.Sc., Professor of Physical Chemistry at the University of Leeds, as one of the four representatives of the University on the Joint Research Committee. Among the new processes to which attention has been given during the past year (although in these instances such attention has not involved practical investigatory work by the Board) are the liquid purification of town gas, the carbonisation of mixtures of coal and pitch, the production of reactive coke, and so on. Progress, it is shown, is being made with the plan for the erection of an exploratory plant for the purpose of transferring on to a larger scale the investigation of the hydrogenation and complete gasification of coal under pressure.

Toluene Yield

OTHER investigations include a series on the action of alkalis on refractory materials. A cone-deformation study has been made of certain alkali/silica/alumina and alkali/silica/alumina/ferric-oxide mixtures. This has been undertaken to supply information on systems which have so far been only partially explored by phase rule methods. Examination has been continued of the phenomena of luminescence and infra-red emission associated with the impact of gas flames upon certain solid substances, while inquiry has been made into the approximate extent to which the yield per ton of coal of benzol, and more particularly of toluene, is increased by the cracking of tar injected into the charge during carbonisation in a continuous vertical retort. These, then, are the hints dropped by an active research board, under the constraint of war-time reticence, that industrial developments are being reared into healthy and vigorous shape behind the scenes.

Ceramic Chemistry

II.—Firing Methods and Pyrometry

by A. BERNARD HOLLOWOOD, M.Sc.

THE Industrial Revolution came late in the pottery industry. It was not until the middle years of the nineteenth century that power-mechanisation was harnessed to begin the transformation of a peasant craft into a modern industry. The transformation is not yet complete. North Staffordshire controls more than 80 per cent. of the ceramic output of Britain and its numerous factories exhibit almost every stage in the development of potting technique, from the simple and unmechanised pot-bank with its brick hovel firing-oven to the mass-production factory with its battery of continuous ovens. The revolution in firing has been long delayed. In the pottery industry the small firm is representative. There is little capital for experiment. But the larger units have already proved the efficiency of tunnel ovens and the day is not far distant when the bottle-necked kiln of tradition will be entirely superseded. The industrial chemist is the key-man in this progress. His problems are numerous and many still await solution.

The Intermittent Oven

Before proceeding to a description of the modern oven it is necessary to look at the intermittent oven and to analyse its imperfections. The most common design is a development from the old beehive oven. The oven itself is insulated from wind and weather by the familiar brickwork "bottle." Between the protecting sheath and the circular, domed oven there is enough space to allow the fireman to charge the grates which lie around the circumference of the base. A common heating system is one in which the flame passes through flues under the floor and through chimneys into the sides of the chamber. A typical oven may be 20 ft. high with a radius of nine ft. and may hold as many as 1800 saggars. Two opposing factors determine these dimensions. Smaller ovens are uneconomical in fuel consumption and larger ovens present great difficulties of loading. The fireclay saggars are stacked in "bungs" or vertical pillars. For some claywares one firing is sufficient; others require a preliminary biscuit firing and a second heat treatment to fuse body and glaze; others, again, require a third treatment to fix on-glaze enamels and decorations. The biscuit oven fires at about 1100° C., consuming at least twice as much fuel as the weight of goods it contains.

The intermittent oven has a heat balance made up in the following manner: heat in ware, 2 per cent.; heat lost in brickwork and through radiation, 36 per cent.; heat in saggars (the saggars weigh about five times the total weight of their contents), 10 per cent.; waste gases, 52 per cent. Effective insulation can reduce losses by radiation and a proportion of the chimney heat can be recovered for boiler firing or drying purposes, but the intermittent oven remains extremely wasteful. Firing by the bottle-necked oven is always a risky business. The leader or "placer" has an all-important task rendered difficult by the differential heating zones inherent in the oven structure. There is no hard and fast rule for the loading of an oven. The types of ware to be fired, the weather, the quality of fuel—all these factors must be carefully reconciled if the placing is to be safe and economical.

Tunnel Firing

The advantages of the continuous oven will be apparent from this analysis. When ware is placed on trucks moving at a controlled speed through a heated chamber the difficulties of placing are eliminated. The intermittent oven requires about 60 hours for the firing process and a similar period for cooling and unloading. The tunnel oven unloads itself and cuts down the cycle of operations very considerably. Heat regulation is scientific and fool-proof and fuel consumption is greatly reduced per unit of production. In addition labour costs of firing are reduced by about 30 per cent.

Tunnel firing was tried on the Continent as early as 1751 and both there and in the U.S.A. a vast amount of experimental work has been done. The U.S.A. has been particularly fortunate in its abundance of cheap natural gas. British

potters have been able to learn much from foreign pioneers, but they have not always had the opportunity to put their knowledge to the test. Where capital is scarce and where new firing methods involve a complete reorganisation of plant and production the tendency is for the small potter to adopt a policy of "wait and see." At the moment the future of tunnel-oven design seems to rest with the relative costs of possible fuels. Ovens fired by producer-gas, town-gas, electricity, coal, pulverised pitch, and tar all have their advocates. Coal at ¾d.-1d. a therm, town-gas at 2d.-4d. a therm, electricity at 7d.-10d. a therm are the chief fuels in use to-day. The work of the ceramic chemist or engineer may give one of them a decisive advantage.

Pyrometers, Old and New

Ordinary thermometers cannot cope with the temperatures needed for the firing of earthenware and china. Round-oven pyrometry has advanced very little since the days of Josiah Wedgwood. The great potter produced an instrument for correlating high temperatures with the contraction of clays. He fashioned a brass tablet with a groove graduated in degrees. His clay test-pieces of fixed dimensions were placed in the oven and fired. Periodically, they were extracted from the oven during the firing operation and measured on the brass scale. This method was perhaps sufficient for the time, but it had serious imperfections. It is now known that clay contraction is not strictly proportional to the degree of heat. In some bodies there is a reaction from shrinkage under continued heat treatment and a counter-expansion. A china body, of china clay, Cornish stone, and calcined bone, reaches its maximum contraction before becoming translucent. Biscuit china gathers heat during the first 20 hours of firing, completes its contraction during the next eight hours and acquires translucency during the remainder of a 48-hour cycle. It is possible to measure temperatures between 300° C. and 850° C. with a thermometer in which the space above the mercury is filled by some inert gas such as nitrogen or carbon dioxide to prevent the mercury from boiling at its normal temperature, but such apparatus is unsuitable for industrial use. The Seger Cones invented by Professors Seger and Cramar of Charlottenburg are the most reliable heat-measuring devices employed to-day in intermittent oven-firing. The cones consist of different mixtures of clays and alkalis and fuse at different temperatures according to their composition. Their ingredients may include quartz, china clay, feldspar, iron oxide, boric oxide, marble, and certain fluxes. The cones are usually arranged in order of their fusion points so that they can be easily observed through the "spy-hole" in the wall of the oven. The bending of the least refractory of the cones indicates that an optimum temperature is imminent, while the most refractory cone, remaining unfused, proves that the heat is not excessive. A similar device is the thermoscope bar. Several clay rods are supported at their ends by a fireclay saddle. The bars sag when their fusion points are reached and provide an easy method of recording fixed temperatures. It should be noted, however, that empirical methods are still highly important in intermittent oven-firing control. Skilled firemen judge the temperature of their ovens by their appearance or by the colour of trial rings of red-burning clay.

High-Temperature Control

Tunnel-oven firing has produced very successful methods of measuring and controlling high temperatures. The firing curve is determined by the design of the oven. There are three zones: a pre-heating zone, a firing zone, and a cooling zone. Heat recaptured from the cooling zone is utilised in pre-heating. The central heating zone is normally under automatic control and special pyrometers are needed. The thermocouple pyrometer is an instrument based on the knowledge that the electric current generated when two suitable metals are joined together is proportional to their temperatures. A galvanometer graduated in degrees of temperature records the condition of the oven. For low temperatures (between 700° and 1000° C.) the metals used may be nickel-copper, nickel-chromium, nickel-iron, etc. For temperatures above 1350° C. the metallic couples may be two nichrome alloys, two rhodio-platinum alloys, or platinum and rhodio-platinum.

Nichrome or the iron-aluminium alloy "kanthol" have proved satisfactory heating elements in electric ovens for temperatures up to 1150° C. or 1200° C. For higher temperatures com-

posite resistors containing carborundum and fireclay and known as Globar and Silit resistors have proved suitable. The design and dimensions of the oven determine the arrangement of the elements. Globar and Silit resistors are usually in the form of rods extending across the interior surface, while nichrome is normally in the form of strips or coils set in channels in the refractory walls.

Fuel Characteristics

Gas ovens using producer-gas or town-gas have proved very successful. Producer fuel may be anthracite coal, coke, or bituminous coal. Bituminous coal, which is present in the Potteries region in good quality and quantity, presents certain difficulties. Tar fog, the chief problem, has been successfully combated by the introduction of electrostatic precipitators. Coke is a good substitute for anthracite coal, but great care must be taken to avoid the passage into the oven of harmful coke-dust particles. For the majority of potters town-gas is almost certainly a better proposition than producer-gas. Its unvarying combustion qualities and purity have already caused mains supply to be preferred in the North Staffordshire area. The design and arrangement of heaters in gas-fired ovens vary considerably. An important problem concerns the stratification of heating power due to the horizontal movement of gases through the oven. Except in the combustion area, where the gases are hotter than the setting, the cold air naturally moves at the lowest level. If uncorrected, this tendency would result in the differential heating of the ware. Improvements are effected by widening the base of the pre-heating zone, by forcing air under slight pressure into the higher levels of the oven and by directing part of the heating gas into the ovens at lower levels.

In recent years tunnel ovens have begun to replace the old intermittent type at an increasing rate. At present gas ovens are usually favoured for biscuit and glost firing, while electric ovens find special employment is enamel kiln heating. The Wedgwood factory at Barlaston seems, however, to have overcome the chief problems of electrical firing with great success—its two-way glost and biscuit oven is fired throughout by electricity—and firing technology may be due for yet another revolution.

Axis Chemical Notes

Some European Reports

THE Reichstelle Chemie in Germany has confiscated stocks of certain types of chemical, including various forms of iodine, cobalt, bismuth, turpentine, waxes, quinine, caffein and other materials. Special exceptions are made for the military, and for research chemists. The manufacture of various textiles has been standardised. Certain articles may no longer be dyed, and others only in colours from standard lists. A writer in the Berlin *Lokal Anzeiger* looks forward to the day when Germany will be able to produce artificial textiles far superior to the products of nature, claiming that great progress in this direction has recently been made. He expects that in future cellulose will be only a by-product from factories for the purification of air.

A German Soda and Caustic Association has been established by the Minister of Economics. Membership will be compulsory for all producers of these materials, and the association will be responsible for market regulation.

Central and Southern Europe

The Hungarian Minister of Agriculture has made a decree fixing the quality of castor oil to be used for aviation purposes. Castor oil below the regulation quality may only be marketed subject to the approval of the Ministries of Agriculture and Defence. From the five cellulose factories of Slovakia, says *Nachrichten für Aussenhandel*, over 10,000 tons a year are being exported to Germany and other parts of Europe. But supplies are now short as there is difficulty in transporting the wood from which it is made. On the completion of a soda cellulose plant by the Slovak Paper Factory, A.G., during the course of this year, all imports of the product into Czechoslovakia will cease.

A new methane plant for Italy which is being built near Turin, will start work in the summer, according to *Il Sole*. It will produce 3500 cubic metres of methane gas daily, thereby saving 1500 tons of petrol annually. A copper sulphate and sulphuric acid factory is to be erected at Pernik, Bulgaria. A factory for the production of synthetic petrol is also being built, states the *Chemiker Zeitung*. It is expected that from an annual 200,000 tons of coal, 33,000 tons of tar, 100,000 tons of coke, and 20 million litres of petrol will be produced.

A chemical company for the production of copper sulphate, superphosphates, sulphuric acid and their by-products has also been founded at Zagreb, Yugoslavia. The price paid to producers for sunflower oil and sunflower fatty acids is to be controlled, according to a report in *Nova Hrvatska*.

Advances in Colloid Chemistry

Some Recently Recorded Progress

by J. J. BIKERMAN

A NEW periodical specialising in colloid chemistry made its appearance last year in the U.S.A. It is called *Advances in Colloid Science* and edited by E. O. Kraemer, of the Biochemical Research Foundation of the Franklin Institute. It is to be hoped that it will be more long-lived than the *Colloid Symposion Monographs*, which merged in the *Journal of Physical Chemistry*, or the *Revue des Colloides*, which lost its individuality after being absorbed by the *Journal de Chimie Physique*. *Kolloid-Zeitschrift* and *Kolloidchemische Beihefte*, in Germany, and *Colloid Journal* in Russia represented for years the sum total of the magazines on colloids.

Study of Particle Size

Two of the reviews collected in the first volume of the "Advances" deal with particle size and its measurement. P. H. Emmett discusses the determination of the particle size of powder from its adsorption isotherm. This is the curve showing the amounts of a gas adsorbed by, say, 1 g. of the powder when the gas pressure varies and the temperature remains constant. For chemically inert gases like nitrogen the curve usually shows a more or less distinct point which is believed to represent the monomolecular covering of the powder surface by the gas. Since the dimensions of gas molecules are known, this gives the total surface area of the powder and therefore its average particle size. If, *e.g.*, the powder consists of nearly cubical particles having the edge l, the total surface area of 1 g. of powder is $6/gl$, g being the specific gravity of the powder material. The method can be used for comparing the size of pigments, catalysts, etc., but, unfortunately, it is too complicated for most industrial laboratories.

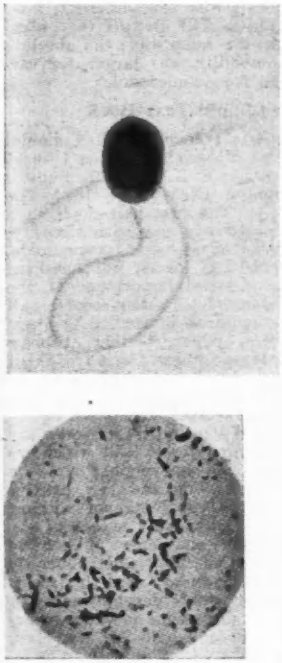
This objection applies perhaps less to the other method reviewed in the "Advances," by R. R. Sullivan and K. L. Hertel. It is based on the permeability of the powder (or a mat of fibres) to streaming air. The volume of air passing through a porous plug in a unit time under given conditions is the smaller the finer are the pores, *i.e.*, the finer the particles. If the plug consists of fibres, needles, discs, or similar particles, its permeability depends also on the preferred orientation of these particles—mainly parallel or mainly normal to the direction of the air current. This technique, though quite generally applicable, would be particularly suitable for testing air filters, heat insulating materials, etc.

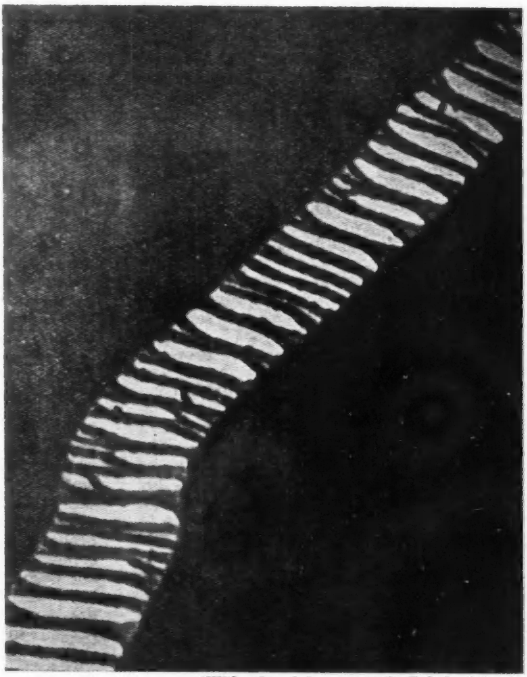
One of the industries closely concerned with particle size is the manufacture of pigments and paints. The hiding power of a paint depends on the dispersity of the pigment as well as on its concentration and the nature of pigment and vehicle. A discussion of this correlation is contributed by R. H. Sawyer to *J. Appl. Phys.*, 1942, *13*, 596. The scattering of light rapidly increases with the particle size when its diameter is less than the wave length of the light used. When the particle is larger than the wave length reflection instead of scattering takes place, its intensity being the higher the higher the dispersity of the specimen. The sum of scattering and reflection, which is decisive for the hiding power, has a maximum when the diameter of the particle is nearly equal to the wave length (*i.e.*, near 5.10^{-5} cm.).

The Electron Microscope

The electron microscope is used nowadays to estimate the particle size of powders, suspensions, or emulsions which are too fine for ordinary microscopes. In contradistinction to the adsorption and permeability techniques which give a summary information about a relatively large sample, the electron microscope gives a much more detailed information confined to a very small sample. Perhaps the most notable feature of the photographs obtained so far by means of an electron microscope is their similarity to ordinary photomicrographs. The particle shape which they reveal is not different from that shown by an optical microscope on larger particles: if the sample contains, say, needles 10^{-3} cm. long which can be recognised as such in a microscope, and also particles too small for microscopical observation, these particles when "viewed" in an electron microscope turn out to be also needles of the same type. Numerous such photographs are collected in the recent book on "The Electron Microscope" by E. F. Burton and W. H. Kohl, New York, 1942, and some examples are illustrated on the opposite page (J. A. Morton, "A Survey of the Research Accomplishments with the R.C.A. Electron Microscope.")

Particles, probably too small even for an electron microscope, are involved in the extensive investigation on metal hydroxide sols published by H. Bassett and R. G. Durrant (*J. Chem Soc.*, 1942, 277). These authors attempt to clarify the constitution of several hydroxide sols, using only analytical data for sols, precipitates, and filtrates





[*With acknowledgements to the R.C.A., Mfg., Co.*

Some examples of the work of the electron microscope : left, comparison between light and electron micrographs—typhoid bacillus magnified 540 and 13,000 diameters ; right, polystyrene, magnified 38,000 diameters.

in conjunction with readings of a glass electrode. If it is remembered that much more varied tools (*e.g.*, electrokinetics) were unable to bring about a decision on this old problem, it is not surprising that the conclusions arrived at by Bassett and Durrant are of a provisional character and couched in laudably cautious terms.

It must be admitted that the probability of elucidating the constitution of sols by standard electrokinetic technique now appears less than ever. Electrokinetic measurements give in the first instance only mobilities (electroösmosis and electrophoresis) or potential differences between two electrodes (streaming and sedimentation potentials). According to Helmholtz's classical theory these mobilities and potential differencs are proportional to, and allow a calculation of, the "electrokinetic ζ potentials " which are supposed to be as important for boundaries between ionic solutions and insulators as the electrochemical potentials are for metal-electrolyte boundaries. Unfortunately, Helmholtz's calculations assume the solid surface to be perfectly smooth and perfectly insulating, two conditions which are satisfied by hardly any real system. Since all solid surfaces are rough, the liquid movement along the solid wall is impeded and the observed mobilities are smaller than the theoretical. Many substances, notably glass, swell in water and aqueous solutions, and, in streaming potential or electroösmosis experiments, the liquid is in contact not with solid glass, which is a good insulator, but with swollen glass, which is not. This results in values of the calculated ζ potential which are lower than the potentials contemplated by Helmholtz (Bikerman, *J. Phys. Chem.*, 1942, *46*, 724). No certain method has yet been found to compute the ratio between the apparent and the real potential

It is generally assumed that the stability of a colloid is a function of the charge on its particles. To find this charge it was often supposed that the charge density was proportional to the ζ potential, and the ζ potential was proportional to the mobility

(or streaming potential). It has just been mentioned that the latter proportionality does not generally hold. The first proportionality is no less doubtful. The charge density is the product of the capacity (per unit area) and the potential, and would be proportional to the latter only if the capacity were a constant. But all the recent measurements of the capacity as well as its theory point to its being a complicated function of potential, concentrations, etc.

Although it is as yet impossible to compute charge and potential of a colloid particle from its electrokinetic behaviour, the mobility itself remains an important property of every colloidal system and can be used in various ways. An improvement in the technique of electrophoresis due to A. Tiselius (*Trans. Farad. Soc.*, 1937, *33*, 524) allows of a characterisation of proteins, protein mixtures, and like substances. The apparatus of Tiselius is now available commercially (A. Hilger, Ltd.) and is recommended for analysis of enzymes, antitoxins, organic polymerisation products, etc. The components of a mixture can not only be detected separately but also separated for preparative purposes; however, although several attempts have already been made to use this possibility in industry they have not been sufficiently determined and large-scale electrophoretic separation still awaits its inceptor.

Electrodeposition

Electrodeposition of colloidal particles is, of course, closely related to that of ordinary ions, *e.g.*, of metals. One obvious difference is the much higher "equivalent weight" of colloidal particles, resulting in a much higher yield reckoned in mass units per coulomb. For instance, the passage of one coulomb deposits not more than 0.33 mg. of zinc or 1.12 mg. of silver, but the amount of kaolin deposited by one coulomb can be as high as 17 mg. for fine grains (less than 5.10^{-5} cm.) and up to 52 mg. for larger grains (5.10^{-5} to 10^{-4} cm.) These values, which incidentally show the importance of the particle size in yet another phenomenon, are taken from a paper by S. Speil and M. R. Thompson (*J. Electrochem. Soc.*, 1942, *81*, 13), who investigated the electroösmotic dewatering of clay at various temperatures, current densities, electrode spacings and acidities, in the presence of caustic soda, sodium pyrophosphate, sodium tannate, or a sodium silicate.

A. J. Ham and W. Hodgson, and A. J. Ham and H. W. Douglas (*Trans. Farad. Soc.*, 1942, *38*, 217, 404) determined electrophoretic mobility as a function of acidity. Mixtures of N/100 hydrochloric acid and N/100 sodium hydroxide were used as the dispersion medium, and carborundum and octadecyl alcohol powders as the disperse phase. Although the chemical natures of these substances are so very different, their mobilities increased with the *p*H (*i.e.*, alkalinity) much in the same way; the absolute value of the mobility was larger for carborundum than for octadecanol.

New Colloid Text-Book

The "Industrial Chemistry of Colloidal and Amorphous Materials" is the title of a new text-book by W. K. Lewis, L. Squires and G. Broughton (New York, 1942, The Macmillan Co.). The first half deals in a more or less customary way with viscosity, surface tension, adsorption, suspensoids, emulsoids, emulsions, foams, etc., without stressing the industrial importance of the phenomena described. In the second half the knowledge acquired is applied to glass, lacquer, plastics, paper, leather, rubber, ceramics, and textile fibres. The treatment here is less specialised than the title of the book would lead one to expect; in the chapter on glass, for instance, the phase equilibrium diagrams of some silicate systems are given, although they refer to salts which are neither colloidal nor amorphous; and the moulding and annealing of glass articles are reported in the usual manner without underlining the "colloidal" aspect of the process. Also in the chapter on rubber the colloidal properties of latex and rubber do not occupy the foreground. But this seems to conform to the newest development. In the course of a discussion on rubber arranged by the Faraday Society in May, 1942, either small parts of a rubber molecule or the molecule itself formed the focus of attention rather than any colloidal particles or any phenomenon due to the rubber's colloidal structure.

This applies also to swelling of rubber. G. S. Whitby, A. B. A. Evans and D. S. Pasternak (*Trans. Farad. Soc.*, 1942, *38*, 269) conclude "that the swelling of an organic colloid such as rubber is basically a process analagous to the solution of a crystalline substance," and G. Gee (*id.*, 276) approaches it from the point of view of miscibility of two liquids. On the other hand, W. M. Barkas (*id.*, 194, 477) stresses the importance of the rigidity of wood to its swelling in water. The swelling pressure of wood at any moisture content depends also on the compressibilities and elasticities of the wood substance; unfortunately, there is more than one compressibility and elasticity, since the mechanical properties of wood are quite different along and across the fibres.

An attempt is being made in Australia, by the Council of Scientific and Industrial Research, to ascertain whether pyrolusite of local origin can be substituted for the imported material used in the manufacture of dry cells.

Some Pointers of Safety Wisdom—III

by JOHN CREEVEY

BECAUSE an unauthorised practice has been followed more than once without ill-effect, do not presume that it is a perfectly safe practice; the hazard may present itself at the ninth occasion.

Sparks from hand-tools ignite an inflammable or explosive vapour; the resulting explosion, as with residual vapour in an otherwise "empty" vessel, ignited at the manhole opening, can be serious from both the material and the personal aspect. Tools made of bronze or some other non-sparking material must be used in such situations.

The tempering of tools is advisedly left in the hands of an experienced person; bad tempering gives a tool which may be a danger to the user as well as to persons within reach of flying splinters. Likewise in the repair of tools more experience is called for than is often apparent; to avoid the need of makeshift repairs, see that the tool room is well supplied with "spares."

The efficient operation of an exhaust system, with hoods for the removal of noxious fumes and gases, depends in no small measure upon maintenance routine, for which one man should be responsible. Proper maintenance of the fan and other moving parts; routine inspection to detect wear or damage throughout the whole system, with timely repair or replacement; measurement of air flow at regular intervals, to show any loss in efficiency; detection of any abuse of the system by employees: these are the duties of maintenance.

Air pressure exceeding 20 lb./sq. in. should never be used for discharging acid or caustic alkali from rail or road tanks. Provision should be made for quickly relieving the air pressure on the tank.

Pipes which have been carrying corrosive liquid need particular care in dismantling or repair, even when they have long been isolated from the rest of the plant and drained; men working on them should be provided with both goggles and rubber gloves, and if necessary (in the case of pipes of large diameter) with rubber aprons and rubber boots. The quantity of trapped liquid which may be released on breaking a joint may not be large, but, being likely to spray under slight accumulated pressure, it can do serious injury; accumulated pressure, due to hydrogen, is noticeable in the case of pipes which have carried dilute sulphuric acid and, inefficiently drained, have been isolated from the rest of the plant for several weeks.

Spillage of corrosive liquid during repair work must be washed away with water at the completion of the job; see that all waste material is also removed, and make a check of tools so that none are left behind in precarious positions.

The frames of electric tools should be properly earthed before any such tools are taken into a metal tank for use.

Smoking, and the possession of matches or other spark-producing material, must be laid down as an offence for all employees who are engaged where inflammable liquids or vapours are in use, or in buildings where inflammable liquids are stored.

Every pulley on a line of shafting needs to be guarded if any part of it is 6 feet or less from the floor or working platform, and in certain circumstances at a greater distance, as where contact might be made by an overhead runway.

Pulleys which are cracked, or which have a broken rim, should be removed from the shafting as soon as the defect is noticed; if a repair is attempted by welding, let the job be done by an experienced man.

Every belt shifter needs some mechanical means which will prevent the belt from creeping from the "loose" to the "tight" pulley.

A belt-tightener is not a safe device for engaging and disengaging power; where the practice has been adopted, if only as a temporary measure, it should be discontinued.

Tanks which cannot be vented direct to the air at both top and bottom must always be regarded as potentially dangerous for a man to enter when the tank is "empty"; if there is a residue of liquid or a wet surface, danger is additionally apparent.

Men detailed for the work of cleaning and repairing tanks from the interior should be medically examined at least three times a year to ensure that they are physically fit to meet any unforeseen contingency. Additionally, they must have proper training in the testing, adjusting, and use of safety equipment which is provided for such situations, with knowledge of the characteristics and hazards of gases and vapours which are likely to be encountered in the course of their work, of procedure in an emergency and in the matter of effecting the rescue of a fellow workman, and of applying resuscitation. An experienced foreman, or some

other responsible person, should personally supervise all work where men need to enter the interior of tanks, and he should see that the safety equipment is complete and in proper working condition.

No man should ever enter a tank where there is likely to be poisonous vapour or a deficiency of oxygen, without the provision of an adequate life-belt and line, gas-mask or air-helmet (as dictated by circumstances), proper protective clothing (including rubber boots and gloves), and standard extension lead for electric light (artificial light being necessary). To meet a possible emergency, there should be an extra mask or helmet, and an extra life-belt and line, ready for immediate use.

Industrial Safety Gleanings

Impressing New Employees : Welding Glass Warning

THERE are occasions when the filters of dust respirators will clog so quickly that breathing becomes difficult within a very short time, *e.g.*, in flues where there is floating soot. The filter material therefore has to be cleaned or changed at short intervals, thus causing annoyance and holding up the job. In Canada this condition has been met by fitting over the respirator a light, home-made cover of net material that catches and holds the bulk of the larger dust particles and so considerably retards the clogging of the filter material in the respirator.

Observation of Hazards

Some firms have a system whereby each foreman, when making an inspection of his area of the factory, asks one of the workers in his department to accompany him. It is suggested that this method helps to train the ordinary worker in the observance of accident hazards. One company, in addition to operating this system, requires the plant superintendent to make periodical inspections of the various departments in company with the foreman.

When a new employee at a big American steel works has passed his physical examination and has received his departmental safety rules, he is taken to what is called the safety stock room. There he receives his protective equipment for his job in the same way as an army recruit is fitted out at the quartermaster's stores. This procedure can be made very impressive to new employees.

There appears to be an increasing demand for welders' blue glass. It is stressed that such glass gives practically no protection against the real hazards of welding. A welding glass must serve two purposes; it must reduce glare to enable a man to see his job clearly, and it must absorb the potentially harmful infra-red and ultra-violet rays. Welders' blue cuts the glare down but transmits 43 per cent. infra-red and 80 per cent. ultra-violet. B.S.S. 679 welders' glass (supplied in five shades) should be used for all types of welding if trouble with the eyes is to be avoided. It is green in tint, cool, and pleasant in use, and gives good definition. Below are some transmission data of various glasses.

	Infra-Red	Ultra-Violet
B.S.S. 679 ...	Nil	Nil
Welders' blue	43.3 per cent.	80 per cent.
Red and blue combination	40 per cent.	75 per cent.

There is also available a glass which is very suitable for welders' mates. It is practically colourless, but will give protection where the worker is exposed to indirect flash. It is specially good for light spot-welding and where a large amount of heat is radiated, such as at gas and electric furnaces or retorts; it transmits only 18.2 per cent. infra-red and no ultra-violet. The name is obtainable from the Information Bureau, The Royal Society for the Prevention of Accidents, 52 Grosvenor Gardens, London, S.W.1, from whose interesting *Bulletin* the above notes have been taken.

The Central Council for Health Education has distributed a series of propaganda leaflets which appeal in the first place to the readers' sense of humour. Slogans such as "Only a Donkey Eats Like a Horse," and questions such as "Is Your Stomach a Fifth Columnist?" draw attention to practical advice designed to cut down sickness and the consequent absenteeism among workers. Full details can be obtained from the General Secretary, Central Council for Health Education, Tavistock House, Tavistock Square, W.C.1.

Production of cerium on a commercial scale in Australia is expected to follow the discovery of a method of manufacture in the metallurgical laboratories of Melbourne Technical College. Mr. Paul Hartmann, formerly of Vienna, and Messrs. A. F. Dunbar and J. McAfee, of the college staff, succeeded in producing it for the first time in Australia. Special apparatus had to be designed for the purpose, states the *Industrial Australian and Mining Standard*, and the experimental work was further handicapped by the limited time and the restricted output of the electrical equipment.

Chemical Progress in Eire

Solving War-Time Problems

by R. M. FOX

CHEMICAL progress in Eire, and scientific progress generally, in relation to present industrial problems has been greatly stimulated by war-time conditions, especially by the need for finding substitutes at home in place of imported materials now no longer available. To help the country in this crisis an Emergency Scientific Research Bureau was set up by the Government in February, 1941. Industrialists welcomed the move and the Federation of Irish Manufacturers asked firms to bring their problems of supply to the Bureau which would endeavour to find some solution. During the first year of its work the Government provided £12,000 to defray expenses and to enable the bureau to conduct special researches and inquiries. But in 1942 its activities had extended so far that £19,000 was allotted to cover the cost. Six leading experts in scientific research constituted the Bureau.

Advance in the chemical and technical aspects of Irish industry is not wholly a war-time feature. Such progress has been going on with increasing effect since the industrial impetus given to Irish economy by the Shannon electricity scheme of 1929 and the pronounced industrial revival which dates from 1932. Everywhere new factories and industries sprang up, bringing with them chemical problems as part of the general productive process. Outside firms—such as Imperial Chemical Industries—helped to supply some of the agricultural and industrial needs. An Industrial Research Council was set up in 1935. Inevitably, in the early period of industrial development, Ireland had to rely to a large extent upon the experience of Britain with its long tradition of successful industry. Even now Ireland does not possess any large or well-defined chemical industry. But it is clear that she has now to do many things for herself which in pre-war times would have been done for her by experts from outside. One effect of the cutting off of imports of essential materials has been to speed up industrial self-reliance not least in what might be termed practical chemistry and in scientific research.

A Bakelite Industry

So far back as 1935, in a remote village on a Tipperary mountain-side, Ireland established her own Bakelite industry in association with firms specialising in such plastic production in Britain from which the raw material was obtained. And the Irish goods rapidly reached such a high standard that an export trade was actually done with Britain. Now the trade in Bakelite caps and stoppers for bottles—in place of unobtainable corks—compensates for the loss of these exports. In 1938, production of tubes for tooth-paste and cosmetics was begun at the same centre. To conserve the available tin—which is in short supply—a method of using tin-coated lead has been initiated. This is a good example of the kind of development which was going on in Eire before the war, and of the changes imposed by war-time production. Everywhere the question of emergency substitutes has come to the front.

Recent Patents

A Government report concerning patents and the trend of invention for the year ended March 31, 1942, points out that foreign applications continued to decrease while the native applications advanced by about 25 per cent., bringing the total figures substantially to the level of the previous year. The report proceeds: "In the field of organic chemistry, there was increased interest in the production of therapeutic compounds, especially synthetic vitamins and vitamin intermediates. A fermentation process for the preparation of 2-ketogluconic acid is noteworthy. In the foods class the bleaching of flour received attention, while the wheat and tea shortages prompted a few Irish inventors to make bread from wheaten flour fortified with potatoes, and derive emergency drinks from selected root-crops and leaves. An interesting German invention in the plastics field comprises a method of welding strips of thermoplastic material for the manufacture of clothing, handkerchiefs, cart awnings, and the like. With the adoption of peat and wood as domestic fuels, much native ingenuity for their efficient utilisation was exercised in provided grates and stoves. Some Irish inventors were busy converting refractory coal dust into readily combustible briquettes, while a foreign applicant proposed to surmount the difficulty of mechanically dehydrating peat by chemical destruction of the cellulose gel which resists the removal of water by pressure. There was only one application for the manufacture of charcoal from peat, a curious fact in view of our rich resources in peat, the enhanced price of charcoal and its suitability as a fuel, for example, in producer-gas propelled motor vehicles.

"The efforts being made at home to cope with the transport difficulties occasioned by the restricted supply of motor fuels were reflected in a substantial increase in applications relating to this subject. The prohibition of the use of town-gas as an alternative fuel diverted attention to the producer-gas generator as the most likely

solution. In another approach to the problem, the use of heavy fuel oils in petrol engines was facilitated by the provision of effective vaporisers. A native contributor suggested a compromise, viz., an engine running on producer-gas being automatically supplied with a variable amount of petrol to enrich the gas in accordance with the changing demands of the load and the quality of the gas. . . ."

Local Raw Materials

For the past two years an Irish Inventions Exhibition has been held annually in the Dublin Mansion House. This is organised by the National Agricultural and Industrial Development Association which lists the principal emergency substitutes as follows: Muckish sand for glass, Avoca ochre for paint, Avoca pyrites for the conversion of phosphates, potash made from kelp, agar-agar from seaweed, barytes from Benbulben for paint, charcoal from wood for producer-gas, straw for paper making, gypsum for cement, gelatine from hides and bones, starch from potatoes, cord from tree bark, lager beer from Irish barley, coffee substitutes from barley and dandelion, peat for gas, carbon dioxide as a by-product of brewing, sulphated oils and sodium sulphide for tanning, wool oil from carrageen.

Among the tasks that call for immediate consideration are listed the possible use of flax as a substitute for cordage, the use of Kilkenny, Tipperary, and County Cork clays for pottery, and the use of bog cotton and sphagnum moss for certain industries. A call is also made for the production of fish meal, meat, and bone meal as substitutes for cotton seed oil, ground nuts, etc. Wood pulping plant is required in connection with the production of paper, while there is a growing need of a substitute for petrol and lubricating oil. Along with this must be considered the manufacture of producer-gas plants, battery-driven vehicles, steam-driven vehicles, and the conversion of boilers for use with peat. All these tasks call for the co-operation of the chemist and the chemical engineer.

Producer-Gas Equipment

Let us look at what has already been done. The main part of the Emergency Scientific Bureau's work has been concerned with fuel problems, this including the manufacture of peat charcoal as a fuel. To discover the best method of producing peat charcoal, the design and erection of a full-scale experimental plant was decided on. Two full-sized retorts, one of fire bricks, the other of cast iron, were erected at the Turf Board's bog at Turraun. Investigation has also been made into the production of peat charcoal in portable kilns which may be more suited to emergency production. Charcoal is required for producer-gas equipment in connection with motor vehicles and also for stationary engines. Already a great deal of charcoal production is being carried on in various parts of the country with both wood and peat as raw material. This has reached such dimensions that it has been described as a new Irish industry. A large wood distillation plant is in operation, using 225 tons of wood per month and producing 56 tons of charcoal. One advantage of the charcoal industry is that inferior scrub wood may be used. An important development is the use of wood and peat for the production of gas in consequence of the shortage of coal throughout the country. Experiments were undertaken by the Bureau at Kilkenny Gas Works. Here, in horizontal retorts, up to 40 per cent. of peat was used in the charge fed to the retorts. In Limerick, the mixture was 60 per cent. peat to 40 per cent. coal, while in Galway only 20 per cent. coal was used. A far more difficult matter was the task of using peat for gas production in up-to-date vertical retorts. This was tried in Limerick, Dundalk, and Dublin. The capital city presented special problems because of the volume of gas required, these problems being concerned both with feeding and with storage space. A report has been issued and the result of the experiments discussed with managers of gas undertakings, which has led to general development on these lines. Peat mixtures have also been used for other industrial purposes throughout the country in place of coal.

Alternative Transport Fuels

Allied with the fuel problem is the no less vital question of transport. Experiments have been conducted to determine the best alternative means of replacing petrol for driving cars and lorries. Many cars are now equipped with producer-gas plants though, for a time, town gas in balloon-like containers was a popular substitute for petrol. The Bureau decided to make laboratory tests to study the comparative utility of the different fuels available. Attempts have been made to develop an electrostatic filter, but difficulty has been experienced in adapting the laboratory instrument for use on a lorry. A wet filter which washed the gases in soda solution and in used lubricating oil has given promising results in service, but oil consumption proved rather high. Such experimental work may prove of the greatest value now that petrol resources are so uncertain.

Before the war, Eire imported large quantities of rock phosphate and sulphur pyrites for the provision of superphosphates needed as fertilisers. Now, in County Clare, 200 tons of phosphate rock are being produced each week, while at Avoca the mining of iron pyrites for the production of sulphuric acid is being carried out. Over 2,000,000 tons of Avoca pyrites were exported to Britain between 1840 and 1870. More Clare

phosphates will be available during the coming season, but shipping space is being provided for imported phosphates at a greatly increased cost. The Bureau recommends an intensive search for natural deposits of fertilisers and the further use of seaweed as manure. These proposals are of a stop-gap character. The difficulty of securing plant prevents the manufacture of artificial manures on the large scale needed.

Other chemical developments include the manufacture of formalin at the Riverstown distillery, with the co-operation of Irish Industrial Alcohol Factories, Ltd. Sufficient quantities can now be made from imported methyl alcohol to meet essential needs (especially to combat foot-and-mouth disease), but to ensure a continued supply of methyl alcohol a private firm hopes to develop a process of wood distillation. Irish-made carbon dioxide is another triumph of the Irish chemist. This material, formerly imported, is an essential factor in creamery refrigeration, and several creameries were threatened with closing down owing to the interruption of imports. The Bureau erected and worked a temporary plant for the production of compressed carbon dioxide. This plant provided for the essential needs of the country, until, with the co-operation of Messrs. Guinness and Industrial Gases, Ltd., arrangements were made for the utilisation of fermentation carbon dioxide. Creameries can now obtain 85 per cent. of normal supplies. The possibility of producing citric acid is being investigated by a Clonmel mineral water manufacturer.

Glycerine Production

Irish-produced glycerin is a recent achievement. For over a year little glycerin has been imported for medicinal purposes. Now an Irish firm, working in co-operation with the Bureau and one of the leading soap manufacturers, has succeeded in producing glycerin of medicinal quality from soapmakers' crude glycerin, which was formerly exported to Britain. Invert sugar has also been manufactured from beet sugar as a substitute for glucose. This, it was reported, was done experimentally for one hospital where the cutting-off of imported glucose threatened serious medical consequences. The product was tested by the Biochemistry Department of University College, Dublin, and it was found that, putting the absorption rate of glucose by the human body at 100 per cent., the invert sugar absorption was 73 per cent.

The thriving tanning industry has been advised in regard to the production of sulphonated oil and sodium sulphide from native materials, while research has investigated the manufacture of various organic acids to meet the shortage of tartaric and citric acids required by the confectionery and other trades. A process has been developed for the production of phosphoric acid. Possibilities of fish-oil production are being examined in view of the general shortage of imported oils. Spent oxide from gas works may be made to yield sulphur for use in existing plants for the manufacture of sulphur dioxide and sulphuric acid. Aluminium sulphate has been produced experimentally. A discovery of commercial use was the method devised to carburise steel for blanks to make table knives, for there is a growing scarcity of all metal goods. Formulæ have been worked out for the preparation of creosote disinfectant and of axle grease, using home materials in place of imported resin oil, and for the production of fatty acids (required for rubber production) from oils available in Eire. An apparatus for the rapid testing of moisture in wood has been perfected and assistance has been given by the Bureau in the manufacture of substitutes for oil and size in the textile industry. Investigations have been carried out with a view to manufacturing carbon black for ink and paint production.

Zinc Oxide : Carbide : Barytes

The first commercial zinc oxide plant in the country has been set up in Dublin, where it was discovered that zinc waste formerly exported could be made to yield zinc oxide urgently required by the Electricity Supply Board and by enamel manufacturers. Output has reached 10 cwt. per week. Neatsfoot oil has been found to have uses for the woollen spinning industry and in tanning, while fatty acids have been provided for polish manufacture. Carbide is being manufactured at Askeaton (Co. Limerick), which will be useful both for domestic and for transport lighting; a further possible use is in acetylene welders. The question of deriving home supplies of insulin from animal glands to be obtained from the Dublin abattoir has been carefully investigated. At present, however, sufficient supplies of insulin are obtainable from Britain. From Galway, following research work at the University, it has been announced that a seaweed suitable for the production of agar-agar has been discovered on the west coast of Ireland. An industrial concern has since been buying up available supplies. Already Ireland is developing its carrageen resources as a food product. To this must be added sphagnum moss, which can take the place of cotton wool, and was extensively used in the last war and also in Canada. An important new industry has been launched in the west, where, from two mines in the Benbulben mountain range, thousands of tons of barytes have been brought to Sligo town. A factory there uses it for manufacturing barium sulphate, for use in the making of paint and in many other manufactures. A molybdenum mine, near

Roundstown, Connemara — worked by a British firm before the last war—may be re-opened if the geological survey is satisfactory.

Irish daily papers have been using newsprint made in Irish mills to supplement their meagre supplies. Unfortunately, the mills are not able to turn out large quantities, but wrapping paper and cardboard made from straw are more plentiful as there are ample supplies of straw available from the harvest. Newsprint made from straw has been used by the *Midland Tribune*, a provincial journal published at Birr (Offaly), but this is suitable only for a flat-bed press, is a dull yellow, and tears easily. To make straw newsprint practicable for general use, the straw must be bleached, and the imported bleaching materials are impossible to obtain except at a prohibitive price. Large-scale production of newsprint depends chiefly on the supply of wood pulp and on machinery which the country does not yet possess. Other lines of development include the growing and processing of chicory for a Dublin firm of coffee merchants, the re-opening of the Athlone starch and glucose factory—closed for twelve years—to manufacture starch glucose, and cornflour from potatoes (potato flour may be added later). The manager of a glue and gelatine factory in Dungarvan, it is reported, claims to have produced a material with the elasticity and durability of rubber. He has applied for a patent which relates to the manufacture of Irish synthetic rubber. About 1000 acres of flax are being grown to replace binder twine which the farmers cannot obtain. Flax may also be used for paper making, and as a substitute for linseed cake and oil. It can also replace cotton thread, though lack of suitable spinning machinery is an obstacle to such development.

Glass for Electric Bulbs

No survey of what has been done could be complete without reference to the achievement of *Solus Teóranta*, the Irish electric bulb manufacturers. Faced with the drying-up of imported supplies of glass, this firm introduced glass made from deposits of Muckish sand, trained old glass workers from the Ringsend Bottle Works in the new technique of bulb-making, used Kilkenny dolomite, and succeeded in maintaining a supply of electric bulbs on the Irish market, actually at a lower price than those formerly imported.

All these advances fall roughly into two categories, the first that of ordinary commercial initiative, the second that of planned research by the Emergency Research Bureau. Often the two have gone together, one helping the other. Much of the help given by the Bureau to industrialists is of a day-to-day character relating to immediate detailed problems, as when a firm of glove manufacturers appealed for help in the matter of gutta-percha blocks which they found difficulty in using. The Bureau diagnosed the trouble and had it put right. Arrangements have been made for " stand by " plants in case of need, *e.g.*, in the production of aluminium sulphate. Help has also been given in the production of calcium carbide and gelatine. An insecticide has been derived from waste tobacco. Compressed ammonia has been produced. These smaller developments illustrate the general trend, but they are subsidiary to the chief work in connection with big problems such as fuel and transport. The investigation of alternative motor fuels, the manufacture of briquettes from slack and the washing of anthracite duff for use as engine fuel, and the work done in connection with synthetic and reclaimed rubber by the Irish Dunlop Co.—all these things indicate the importance of chemistry in solving the industrial war-time problems of Eire.

Irish Metal Production

Recent Investigations

IN the field of metal production Irish research has also been active. Last month in the Dáil, for example, Mr. de Valera, in the course of moving a vote for an increased estimate on behalf of the Emergency Scientific Research Bureau, spoke as follows:

" Investigations under the head of iron and steel include an examination of the possibilities of relieving shortages of special alloy steel by the re-manufacture of scrap, experiments on the production of iron by electro-deposition, investigations on the use of substitute fuels for melting iron, and the production of ferro-silicon for foundries. Following satisfactory laboratory experiments, the production of electrolytic iron on the large scale is now being studied with specially adapted plant and equipment. It is hoped that production on this plant will commence in the near future. Satisfactory results have been obtained from experiments on the melting of iron with hard turf charcoal made by high temperature carbonisation in gas-works retorts. An investigation is also in progress with a view to arrangements for the repair and manufacture of lead batteries in the country. A study has been made of the treatment of wood for the production of the separators and experimental work has been carried out in a specially constructed furnace on the preparation of the lead oxides required. Preliminary work is also being conducted into the possibility of recovering zinc from used dry cells.

Professor J. J. Dowling, Chairman of the Emergency Scientific Research Bureau, in an account of the working of this body given

to the Chemical Society of University College, Dublin, showed his audience electrotytic iron—one of the metals derived from Irish ores—" a very difficult problem." He was not yet, however, in a position to say whether the Bureau could recover zinc and tin by the electrolytic process.

Deposits of iron ore being likely to be found in the Arklow district of County Wicklow, the Minister for Industry and Commerce has acquired the right to work minerals in several districts in that neighbourhood. These mining rights will be leased to the Mineral Exploitation and Development Co., which is making an investigation into the whole question, and will undertake the realisation of the workable quantities of ore whose existence may be established.

Health in the Factory

Course for Industrial M.O.'s

A WEEK-END course for medical practitioners on factory medical services and industrial diseases is being held at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1, on Saturday and Sunday, February 27 and 28. On the Saturday, the proceedings will be opened by Sir Wilfred Garrett, H.M. Chief Inspector of Factories, at 2 p.m. Lectures, each lasting an hour, will be delivered as follows:

Saturday, 2.15 p.m., " Industrial Diseases of the Lungs," by A. J. Amor, M.D., M.Sc. (Deputy Chief Medical Officer, Ministry of Supply); 4.15 p.m., " Skin Lesions arising from Coal Distillation," by W. D. Jenkins, B.A., M.R.C.S., L.R.C.P. (Chief Medical Officer, South Metropolitan Gas Company).

Sunday, 10.15 a.m., " The Investigation of Toxic Hazards," by M. W. Goldblatt, M.D., B.Ch., B.Sc. (Group Medical Officer, I.C.I., Ltd., and Chairman, Association of Industrial Medical Officers); 11.45 a.m., " A Method of Assessment of Physical Requirements for Processes with Reference to Routine Medical Examinations," by H. B. Trumper, M.A., M.B., B.Ch. (Officer in charge of the Medical and Welfare Section of the Central Labour Department); 2.15 p.m., " Industrial Fracture," by A. H. Bennett, M.R.C.S., L.R.C.P. (Surgeon, Victoria Infirmary, Northwich; Medical Officer, I.C.I. (Alkali), Ltd.); 3.45 p.m., " Recent Work on Antiseptics," by A. R. Martin, B.Sc., Ph.D., Dip. Bact. (Biological Department, I.C.I., Ltd.).

Luncheon will be served on the Sunday at 1.15 p.m., and tea on the Saturday at 3.45 p.m., and on the Sunday at 5 p.m. The fee of one guinea for the course, and 2s. 6d. if lunch is required, should be sent to the Secretary, London School of Hygiene and Tropical Medicine, not later than Monday, February 22.

C

Coal in the Chemical Industry

Some American Research

NEW uses for coal in the chemical industry were described by H. C. Howard, of the Carnegie Institute of Technology, to the Division of Gas and Fuel Chemistry of the American Chemical Society at the recent convention.

Low-boiling fractions in by-products from the carbonisation of coal have been the almost exclusive source of aromatic compounds for the chemical industry. Recent large demands for benzene, toluene, naphthalene, and phenolic compounds and some of their derived products such as aliphatic and aromatic dicarboxylic acids naturally lead to consideration of other possible sources of these compounds.

Direct degradation of bituminous coal can furnish in good yields any desired range of molecular sizes of carbo- and heterocyclic structures. The more complex are naturally the easier to produce. In the presence of certain solvents at temperatures up to 350° C., as much as 80 per cent. of bituminous coal can be converted to ash-free "bitumens," condensed cyclic structures of molecular weight ranging from a few hundred up to perhaps a thousand. Mild oxidation reactions produce the so-called " regenerated humic acids " of nuclear structure similar to the bitumens, but with sufficient peripheral polar groups to give them acid properties, as evidenced by their solubility in alkaline reagents and their ability to form salts.

Distillable Hydrocarbons

More drastic degradation of bituminous coals, in the presence of hydrogen, at 400°-500° leads to simpler molecular types which are, for the most part, distillable. These are predominantly aromatic hydrocarbons although significant amounts of naphthenes and paraffins are also present. Under certain conditions, an appreciable fraction of the oxygen of the coal may appear as phenolic compounds, and of the nitrogen as organic bases. Oxidation at elevated pressures and temperatures results in production of simple aliphatic acids such as acetic and oxalic, along with aromatic acids of the benzene carboxylic series, from the phthalics to mellitic, and other polycarboxylic acids of more complex nuclei.

Increasing demands of the synthetic chemical industry for aromatic structures may be met by application of these methods of degradation either directly to bituminous coals or to the complex cyclic structures from coke ovens, the tars and pitches, which for the most part are now either used for structural purposes or are burned.

Turkish Chrome

Supplies for Britain and Germany in Question

THE Anglo-Turkish chrome agreement which was originally signed on January 8, 1940, expired on January 8, 1943. According to that agreement, which has been extended till now, Britain—after the default of France—had an exclusive option on the entire Turkish chrome production. As regards the future, although official circles maintain their usual reserve, the Ankara correspondent of *The Times* states that it is understood that friendly conversations have made good progress, with the object of reconciling British chrome requirements with the previous commitments entered into by Turkey.

The Clodius Agreements

Those commitments refer to the agreements signed by Turkey and Germany in October, 1941, known as the Clodius agreements, the references to chrome in which are extremely involved and have given rise to much controversy during the last few months. Roughly, they amount to this: Between January 15 and March 31, 1943, Turkey and Germany will exchange goods to the value of £T55,000,000, including 45,000 tons of chrome on the Turkish side, and war material of the value of £T18,000,000 on the German side It now seems to be established that the Germans will obtain supplies of chrome in proportion to the amount of war material and other goods delivered by them to Turkey by the end of March, 1943. According to the same agreement Germany may obtain from Turkey an additional 45,000 tons of chrome during the rest of 1943, and another 90,000 tons in 1944, against delivery of war material to Turkey, but these further deliveries become operative only if Germany has delivered by March, 1943, the entire quantity of war material provided for in the first paragraph of the agreement. Reports have indicated that the Turks are dissatisfied with the quality of the war material so far delivered.

Contingent Conditions

The application of these complicated agreements is contingent on other conditions, such as the ability of Germany to supply the requisite amount of war material, and Turkey's ability to provide labour for the extraction of chrome as well as to overcome transport difficulties, and so on. Another debatable question is whether the war material, which will be supplied by Germany to Turkey under the 100,000,000 Reichsmark credit, details of which have just been settled in Berlin, and which is supposed to be totally unconnected with the Clodius agreements, will be considered as a German *quid pro quo* entitling them to receive Turkish chrome on the conditions stated above.

The British Government, says the financial correspondent of *The Times*, is now being assisted in the negotiations for a renewal of its agreement by the United States, which is supplying Turkey with various products on Lend-Lease terms. On October 8 last it was reported from Ankara that Mr. Macmurray, the American Ambassador to Turkey, had presented M. Sarajoglu a note which drew the attention of the Turkish Government to the fact that the United States, though not directly participating in the British contract, was vitally interested in the maintenance of Turkish chrome supplies to the United Nations.

Old Mines Reopened

There are indications that Turkey's output of chrome ore, after falling materially in the first two years of war, has risen again through the fuller utilisation of the old mining areas in the western part of the country, which since the middle of the last decade had been largely superseded by the development of new mines in eastern Anatolia. Before the war Turkey used to supply over 200,000 tons of chrome ore a year (*i.e.*, one-fifth of world production), but in 1940 its supplies had fallen to 110,000 tons. The current rate of production appears to be near the pre-war rate, although definite information is not available.

Meanwhile allied supplies of chrome ore from other sources than Turkey are on the up grade. Developments have been particularly active in recent months in South Africa, Southern Rhodesia, and India, as well as in America. The United States has initiated an extensive scheme to assure large supplies of chrome through concentration of low grade ore.

PAINT SCHEME DROPPED

The plan to concentrate the paint and varnish industry, which has been under review as a result of representations from many firms in the industry, will not now be proceeded with. Mr. Dalton, the President of the Board of Trade, has sent a memorandum to this effect to the National Federation of Associated Paint, Colour, and Varnish Manufacturers of the United Kingdom. Although there will now be no compulsory scheme, the Board of Trade is prepared to authorise voluntary arrangements between firms for the transfer of production to ease the labour and raw-materials position.

"The Changing Scene"

The Technical Development of National Resources

by PROFESSOR D. T. A. TOWNEND, D.Sc.

IN an address to the recently formed Tees-side Section of the Institute of Chemistry, the Livesey Professor congratulated the Section on its formation and was honoured to give the first address following that of the President. He thought technical people ought now to be thinking about issues broader than those coming within their immediate occupation and interests. Under the title "The Changing Scene," he proposed to indicate the importance of changes which seemed imminent, firstly in the national economy and secondly in technical developments; both issues were inseparable from the subject of "Coal."

Our general education was sadly inappropriate for a people whose livelihood depended on industry; where, for example, was the background necessary to understand current affairs? We had learned much about Alfred and the cakes, and Henry VIII's wives, but very little about the industrial revolution and the economic crises of the present century. Apart from the "bad men of the Axis," what were the other conditions which had contributed to make war possible? A clue was obvious in the Atlantic Charter; "The Democracies will endeavour . . . to further the enjoyment of all states . . . of access on equal terms to the *trade* and to the raw materials of the world which are needed for their economic prosperity."

World Fuel Resources

The industrial prosperity of any country and the trade which it brings, depends primarily on the fuel resources it possesses and the efficiency with which they are turned to best advantage. Some 75 per cent. of the world's power was derived from coal; in this country prosperity depended entirely upon coal. Much of the world's reserves of solid fuels consisted of inferior lignite; we, in this country, had been richly endowed with the bituminous coals on which industry normally depends. Most of the world's reserves of coal and oil were in the Continent of America. Some 10 per cent. of the coal was located in Europe; of this, Germany had 5.7 per cent., and Great Britain had only 2.6 per cent. During the industrial revolution we had been using this coal with no regard to the future; our most easily worked seams were being devoured and the reserve of special, *e.g.*, coking, coals was dwindling fast.

Seventy-five per cent. of the world's output of coal had been supplied by U.S.A., Great Britain, and Germany. We had been the pioneers. The output of coal in this country had risen steadily without a break since the beginning of the 18th century, until in 1913 it reached 290 million tons. The output of U.S.A. started at a later period, but rapidly overtook our own, reaching 508 million tons in 1913. The rise in the German output was most marked towards the end of the 19th century and, including lignites, was, in 1913, approaching our own production. The increase in the output of coal went hand in hand with the growth of population and trade. The U.S.A. was largely self supporting; Great Britain and Germany had both developed industry and neglected agriculture.

Imports and Exports—Millions of £.

	1875	1913	Per cent. Increase
United Kingdom ...	656	1186	81
Germany	300	1021	240
U.S.A	200	868	334

The first world war saw the end of the phenomenal rise in coal output, and it is the view of many—as indeed is the implication of the Atlantic Charter—that stable conditions will not return until an international understanding on trade conditions has been concluded. To quote Professor Hayes of Columbia University on "Causes of the World War"; "We must not take too seriously a few actors who strutted on the stage of European politics in 1914, and who by cowardice or cunning precipitated armed conflict. They would have been quite unable to precipitate any international war, much less a world war, had they not been, in common with millions of common people, the more or less willing agents of immense forces which had, for many generations, been predisposing the world to mortal combat.

Coal Exports

"The attempt of Germany to obtain a commanding position in the world trade and in overseas domination excited not only German nationalism, but the nationalism of France and of England, too. It was indeed characteristic of the new age that men of business were pushing their several Governments into intense rivalries with one another, while patriots were pulling and applauding and that armies and navies were standing ready to enforce economic interests and national honour."

A fact not generally appreciated is the important part which coal export has played

in the trade of this country. In 1810 we exported 13 per cent. of our total production, but in 1913 this figure had risen to 33 per cent., or in all 98 million tons. This was facilitated by the good quality of our coal and the proximity of coalfields to our extensive coast line; indeed 80 per cent. of the seaborne coal traffic of the world was in British ships. Coal export enabled our shipping always to enjoy full holds—incoming cargoes of large bulk being compensated by outgoing cargoes of manufactured goods of smaller bulk plus coal; thus freights were low. Indeed, 10-20 per cent. of our total exports consisted in coal.

The output and export of coal have never again approached the peak figures of 1913; this has been largely due partly to the increasing production of coal elsewhere, particularly of lignites, and partly to a welcome increase in efficiency of most large fuel-consuming industries. It seems likely also that a decrease in the export of manufactures will have to be faced; that is apart from any outcome of the terms of the Atlantic Charter, and mainly due to our shortage of foreign currency, a temporary shortage of shipping, and the development of industry elsewhere—particularly in the Dominions and Colonies.

Conserving National Resources

Coal export should be controlled in the national interest. This generation is, after all, only a trustee for posterity. What appears to have been lacking more than anything else in the later period of the industrial revolution was a Ministry of National Planning. To quote Dr. E. W. Smith[1]: "To sell coal to the foreigner in the way in which it was sold in many cases was crazy. Our policy must be to conserve our resources and to use them to the best advantage. In our consideration of the whole problem, it was wrong to start with methods of stimulating the consumption of coal. . . . We should determine which forms of fuel were best for particular purposes—and how these forms of fuel should be used."

Passing to the general question of our export trade, let us also heed the words of Sir Louis Beale, Director of British Supply Council in North America[2]: "When our Allies sit with us at the Council Table of the world, they will say 'We have fought; we have suffered; we have spilt our blood in the same cause as yours. We have shown ourselves as men.' Dare we of the western world say to these, our Allies 'But look at our machinery! Look at our factories! Look at our conquest over nature! We have been the pioneers of progress; the standard bearers of civilisation.' I fear, gentlemen, that the answer may leave us speechless: 'Look where your civilisation has led us all.'

"We are all bound by the Atlantic Charter. What has been promised by the Atlantic Charter? Economic equality. That is, access to raw materials and proximation to freedom of trade. The corollary is sure and certain. It is a hard gospel, but I believe it is inevitable that all nations must live by merit and not by favour, and that means brains, courage, endurance, and sacrifice."

Thus we have "The Changing Scene" in the national economy. Two important points appear to emerge. The first is that this country must now continue to ensure much greater food production, the second that greater efficiency in industry is necessary for markets may be restricted and no longer should our trading be subsidised by coal export.

Let us, therefore, now consider briefly the question of efficiency. We have been a great pioneering country; there is no doubt, however, that our efficiency has been impaired, firstly by factors contributing to maintain our markets, and secondly because our bituminous coals have not presented many major industrial problems. To illustrate this point: the oil industry has probably now become the most progressive synthetic chemical industry. Why? In the second decade of this century it was faced with two problems; the first to get from crude oil a much greater yield of light spirit, and the second to produce a light spirit which could be used efficiently in internal combustion engines, employing ever-increasing compression ratios. The story is enthralling. No longer is crude petroleum merely distilled, but in succession we have seen the development of cracking, hydrogenation, polymerisation, isomerisation, etc., and latterly the development of a complex synthetic chemical industry, so that to-day all manner of chemical products are produced; good aviation spirit appears to be just as much a synthetic product as an aspirin tablet. This has been rendered possible by the remarkable progress made since the last war in the determination and application of physico-chemical data.

A New Attitude

The repercussions of these advances may in time help in the better processing of coal, although coal is a material chemically less amenable to such treatments. None the less our viewpoint is rapidly changing. Fifteen or twenty years ago the outlook of the chemist would be that if he took a lump of coal, heated it to a certain temperature, then by the Grace of Providence certain products would be obtainable. To-day the attitude would be that were he to start with any material composed of so much carbon, hydrogen, oxygen, etc., he could, given adequate data, sit down and forecast the possible products. There is no magic in the fact that during low-temperature carbonisa-

tion gaseous olefines are obtainable, while in high-temperature carbonisation, these are replaced by aromatic compounds; nor yet that low-temperature tars differ from high-temperature tars. All that is involved is the shift towards equilibrium in systems involving the aromatisation of olefines, etc. The difference between coal and crude petroleum as starting material is that it is already essentially a condensed aromatic structure.

Let us pass to a second illustration by considering present developments in the gasification of coal. After the last war Germany, under the Versailles Treaty, lost some of her best coalfields and was forced to turn to advantage her large reserves of inferior lignites. There is again a fascinating story. It is difficult to make gas from lignites by established methods of distillation; the German, however, by developing a process of high-pressure gasification of lignite in oxygen and steam, which anticipated a catalytic conversion of water-gas to methane, was able to manufacture a gas of calorific value and composition comparable with town-gas. And high-pressure working was shown to possess advantages in both purification and distribution.

For the Future

These illustrations mark two revolutionary developments which have arisen as the outcome of industries being "up against it." How are we, in this country, in future to use our coal reserves more efficiently? Only a brief indication of the trend of development can now be given, and reference may be made to the recent developments in the researches being undertaken by the gas industry. Our aims in developing methods of processing coal, particularly in relation to gas manufacture, have recently been defined somewhat as follows[3]:—(1) To employ a wide range of coal so that there are no limitations placed upon caking power or ash content; (2) to make gas produce only such a proportion of coke as may meet the demand; (3) to produce a tar that can be readily hydrogenated to liquid fuel; (4) to treat coal in a vessel self-heated internally, thus avoiding external heating with its low efficiency and loss of sensible heat in the gaseous products. To this one may add: (5) to link new methods of processing coal with the production of synthetic chemicals.

It is pleasing to report that considerable progress is being made along these lines by the chemists of the Gas Research Board working at Leeds University. Much information has been forthcoming as to how our own bituminous coals can be gasified by high-pressure methods. An important step in this connection was the discovery by Dr. Dent and his colleagues of the direct complete hydrogenation of coal to methane. Cognate investigations have involved an exhaustive inquiry into the mechanism of the Sabatier synthesis of methane from water-gas as well as the necessary purification of industrial gases from sulphur compounds. And recently attention has been given to utilising the potential energy in the compressed gaseous products.

The development of all the possibilities involved will take some years yet: but it is possible to visualise an era when coal will no longer be thrown into a retort to secure chance products of carbonisation, but processed so that its potential energy may be used in forms best suited to meet special needs for heat and power, while at the same time suitable products may be applied to chemical synthesis. So we see "The Changing Scene" in technical development; only by such advances will our efficiency reach the standard now called for.

REFERENCES.

[1] Lecture to the Fuel Luncheon Club, March 26, 1942.
[2] Address on "Men and Machinery" to the American Society of Mechanical Engineers, 1942.
[3] E. V. Evans. Address to Midland Association of Gas Engineers, November, 1942

Institute of Chemistry

Annual General Meeting Announced

IT is announced that the next annual general meeting of the Institute of Chemistry will be held on Monday, March 1, at 30 Russell Square, London, W.C.2. In accordance with the by-laws, certain officers and general members of Council retire at the meeting and will be ineligible for re-election; their names are as follows: *President*: J. J. Fox, C.B., O.B.E.; *Vice-Presidents*: H. V. A. Briscoe, G. Roche Lynch, O.B.E., Sir Robert H. Pickard, F.R.S., H. A. Tempany, C.M.G., C.B.E.; *General Members of Council*: E. B. Anderson, A. Coulthard, J. C. Drummond, F. P. Dunn, A. E. Dunstan, I. M. Heilbron, D.S.O., F.R.S., G. W. Monier-Williams, O.B.E., M.C., J. R. Nicholls, T. F. E. Rhead, and W. H. Roberts.

Nominations for the new Council must be delivered to the Institute before 2.30 p.m. on January 18. District members of Council who have retired in favour of other nominees are Messrs. E. E. Ayling (Wales and Monmouth), L. Fletcher (Edinburgh and E. Scotland), and S. W. A. Wikner (Newcastle and N.E. Coast).

It is hoped to arrange examinations for the Associateship and Fellowship in April; associates who desire to offer themselves for examination should forward their applications forthwith.

At the last meeting of Council, three new Fellows were elected, 12 Associates were elected to the Fellowship, 33 new Associates were elected, and 40 Students admitted. The deaths of seven Fellows, five Associates, and one Student are recorded.

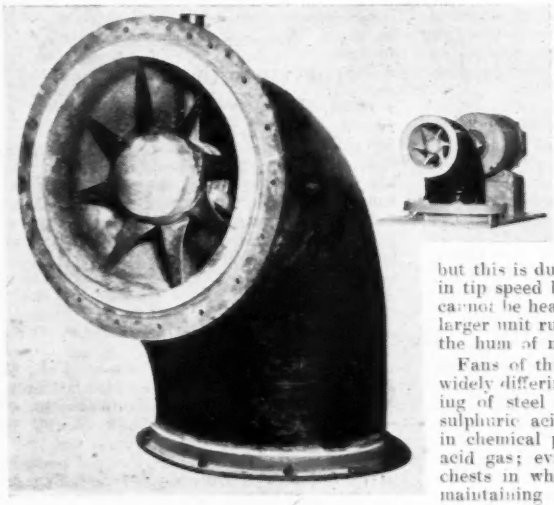
Axial Flow Fans

Improved New Kestner Design

RECENT advance in the knowlege of applied aerodynamics has enabled engineers to design draughting fans for high volumes at relatively low pressure which surpass in efficiency anything hitherto produced. These fans are of the axial flow type in which the impeller, carrying a number of accurately-shaped aerofoil section blades, rotates in a cylindrical casing imparting a forward motion to the flow of gas in a direction parallel to the axis of the impeller.

The Kestner Evaporator & Engineering Co., Ltd., have taken full advantage of these new principles in fan design and have developed a complete range of axial flow fans in all sizes from 4 in. to 4 ft. dia. built entirely in acid-resisting materials. Most interesting of these new fans are those made in Keebush, a corrosion-resisting plastic material which is unaffected by almost all acid and corrosive gases. In these fans the balance and smooth running of the impeller are not impaired by corrosion.

It is interesting to note that the acid-resisting property of these fans is not dependent on a mere surface layer or protective coating, since both the impeller and the casing are made in solid Keebush, which is corrosion-resistant throughout its entire mass. Consequently, no shutdowns are required for repainting or attention to the internal surface of the fan parts. Two ball or roller bearings are fitted, one inside the fan, the other ouside. The internal bearings are completely cased in a Keebush sheath. Easily accessible external grease cups are provided which communicate to the internal bearing races through Keebush pipes. For certain conditions the internal ball or roller bearings can be replaced by all-Keebush bearings of the sleeve type, provided with water lubrication. Special models are also made in two, three, and four sets of blades mounted on a single impeller shaft giving pressures up to 4 in. w.g. The accompanying photograph shows side by side a 4 in. and a 24 in. diameter axial flow fan, each being made entirely of Keebush. The larger machine is arranged for belt drive and will handle 6000 c.f.m. of air or gas at $\frac{1}{4}$ in. w.g. when running at 1800 r.p.m., taking less than 2 h.p. The smaller machine is direct-coupled to an electric $\frac{1}{2}$ h.p. motor running at 2800 r.p.m. passing 30 c.f.m. Axial fans are often associated with noise, but this is due to incorrect design, resulting in tip speed howl. The small fan illustrated cannot be heard when running, and even the larger unit running at 2100 r.p.m. only gives the hum of normal air movement.



Kestner axial flow fans of 24-inch and 4-inch diameter, each constructed of corrosion-resisting "Keebush."

Fans of this type are now being used for widely differing purposes, including draughting of steel pickling tanks containing hot sulphuric acid; exhausting reaction vessels in chemical processes evolving hydrochloric acid gas; evacuating paper pulp treatment chests in which chlorine is employed; and maintaining a wholesome atmosphere in tanneries where sulphur dioxide fumes are generated.

Unlike centrifugal fans, axial flow fans can cause overloading of the driving motor unless they are properly designed. Care has been taken on all Kestner axial flow fans to prevent overloading by suitable blade design, and apart from normal performance and specific duty tests, complete stalling tests are carried out to check the possibility of overloading.

Where lower pressures than about 1 in. w.g. are needed, it is claimed that these fans can be relied on to give long and trouble-free service at a lower prime cost than any volute-cased fan of the same capacity.

Rye

Development for Human Consumption and Industry

TO the layman, and largely even to the industrial chemist, the principal function of cereals is to provide food. Their component parts, however, are capable of being processed for many industrial uses—starch, glucose, and gum are among the first that come to mind. The re-development on British soil of a cereal which has been " out of fashion " in these islands for 200 years has therefore a double importance, and it is interesting to learn of the research work that is going on in this direction. One of the latest cereals to be scientifically developed in this country is rye, normally much more familiar in continental Europe. Its investigation takes on a special importance in time of war.

Rye, in many respects, closely resembles wheat, having a very similar starch content, but it contains no gluten, the protein being largely a gliadin which confers on rye flour its special baking characteristics. There are considerable varietal differences among ryes, the protein content varying from 6 to 10 per cent. The grain contains between 65 and 70 per cent. of starch accompanied by considerable amounts of gum, and ranks high among cereals in respect of vitamin content.

Extensive research has been carried out of late years by the Ryvita Company on the classification of the various rye seed types, with the object of improving them, and at the same time assessing the best uses to which individual types are suited. Seed selection research has done much to increase yields per acre, the object being to increase the average to 20 cwt. per acre from the previous standard of 12-13 cwt. Results have been very encouraging, yields as high as 30-35 cwt. per acre having been obtained. Rye thrives on light, sandy, acid soils where the cultivation of other cereals would be uneconomic, if not impossible. It does not, therefore, compete with other crops for its share of the limited acreage of this country: it offers instead a useful food crop from land which would otherwise produce less weight of food per acre if cropped with any other cereal, or would remain simply as rough grazing land of much lower food potential.

Rye Products

Rye is usally dealt with by milling, but it can be flaked in the same way as maize and malted like barley. The flakes can be used for brewing, or, when toasted, for human food. Rye malt can be milled into flour for use in bread-making, the manufacture of malt extracts, vinegar, etc. Rye flour or meal is the basis of the many types of rye bread familiar on the Continent, particularly in Scandinavia. " Ryvita " is the British rye bread manufactured with special regard to the English palate; it is claimed to partake of all the well-known nutritive properties of this group of foods.

Tests have shown that rye flour or meal may be blended with wheaten flour or meal to produce excellent bread of the usual loaf type, so that if and when the time comes for this addition to be made to the National Loaf, it should not be regarded merely as another form of war-time dilution, but rather as something representing an interesting innovation in national nutrition.

Industrial Uses

In the absence or short supply during the war of maize and rice, rye has come to play an important part industrially also. In the form of flour it is being used in the manufacture of glucose, and for gums and pastes for various classes of adhesive work. It has possibilities as an alternative for more usual materials in the laundry industry and for textile work, though for this latter purpose rye starch itself would be most suitable. Rye is capable of yielding first-class starch in powder or crystal form with very desirable properties for a considerable field of work. Given suitable plant, thousands of tons of this could be manufactured, but this yet remains to be done on a large scale in this country.

German Rubber Waste

Attempts to Obtain Motor Fuel

EXPERIMENTS made to obtain motor fuels and fuel oil from rubber waste are described in the German journal, *Brennstoff Chemie*. Low temperature distillation of rubber waste at 500°-750°C. in a large laboratory plant yielded 46 per cent. coke, 35 per cent. tar, 7 per cent. liquor, and 12 per cent. gas, and losses in weight. The coke is not suitable for active carbon or fuel, owing to its high ash content and low heat of wetting. On distillation, however, the tar yielded 16 per cent. benzene, 50.7 per cent. diesel oil, and 32.3 per cent. by weight residual oil. The benzene fraction consists mainly of aromatic hydrocarbons and is stated to have a high anti-knock factor, but owing to its high sulphur content and relatively poor ignitability, the diesel oil fraction has to be blended with synthetic or petroleum fuels. The process seems of only theoretical interest in view of the low fuel yield and of the small amount of rubber waste available.

Personal Notes

SIR REGINALD ST JOHNSTON has been appointed to supervise the interests of the raw materials department of the Ministry of Supply in the Midlands. His office is at the Birmingham Chamber of Commerce.

PROFESSOR J. W. COOK has been appointed to succeed SIR ROBERT PICKARD as representative of the Institute of Chemistry on the National Committee for Chemistry, for a period of six years beginning January 1, 1943.

Thos. W. Ward, Ltd., announce that MR. E. G. MORT, general manager of Briton Ferry Works; MR. J. S. BRADSHAW, of the Scrap Iron and Steel Department; and MR. F. W. ROBINSON of the Foundry Supplies Department, have been appointed local directors.

SIR GEORGE NELSON, whose knighthood for services rendered to the Ministry of Aircraft Production and the Ministry of Supply was in the New Year Honours List, has been nominated chairman of the Federation of British Industries, in succession to Lord Dudley Gordon.

DR. ARTHUR B. LAMB, Professor of Chemistry at Harvard University, has been elected Nichols Medallist for 1943. The award will be made on March 5 at a joint meeting of the American Chemical Society (New York Section) and the Society of Chemical Industry, at the Chemists' Club, New York.

MR. FELIX L. LEVY, who is on the Board of George Cohen, Sons & Co., Ltd. and of T. C. Jones & Co., Ltd., has been appointed a director of Kryn & Lahy (1928), Ltd., engineers and steel founders, Letchworth, Herts. He is at present seconded to the Ministry of Supply as Assistant Director of Scrap Supplies.

DR. G. S. WHITBY, formerly Director of the Chemical Research Laboratory of the D.S.I.R. at Teddington, has accepted the post of Professor of Rubber Chemistry at the University of Akron, Ohio, U.S.A. He has also been appointed chairman of the Technical Advisory Committee of the Polymer Corporation, Ltd., the Canadian Government agency responsible for synthetic rubber manufacture in the Dominion.

MR. A. L. BACHARACH and MR. F. P. DUNN have been selected as representatives of the Council of the Institute of Chemistry on a special committee to report to the Chemical Council on the question of promoting increased membership of the three co-ordinated chemical bodies. Mr Bacharach has also succeeded DR. H. A. TEMPANY as representative of the Institute on the Chemical Council.

The following have been elected officers of the Therapeutic Research Corporation, for the year beginning January 1, 1943; it has been agreed that there shall be yearly changes in these appointments. Chairman and deputy-chairman of the board of directors: DR. T. B. MAXWELL (May & Baker, Ltd.), and MR. HARRY JEPHCOTT (Glaxo Laboratories, Ltd.); chairman and deputy-chairman of the research panel: DR. F. L. PYMAN (Boots Pure Drug Co., Ltd.), and DR. J. W. TREVAN (The Wellcome Foundation, Ltd.).

Obituary

MR. W. Y. LONGMORE, senior partner in the firm of Longmore Bros., Springfield Steel Works, Darlaston, has died at Walsall, aged 66.

MR. ALBERT VICTOR REIS, who died at Cowdenbeath on January 10, was a member of the Institute of Mining and Metallurgy, and was formerly director of the Manchester Collieries.

MR. J. T. MACDONALD, M.A., B.Sc., Acting Principal of Lewisham Technical College, London, has died in London at the age of 65. He had previously taught at Invergordon Academy, Peterculter, and Morgan Academy, Dundee. During the last war he was analytical chemist at Woolwich Arsenal, and in 1920 he became technical assistant in technology to the L.C.C.

Refractory Manufacture

Test Code for Kilns

THE British Standards Institution has published a group of test codes for kilns for Heavy Clay Ware including refractory materials (B.S. 1081-1942). The codes have been prepared to cover the testing of intermittent continuous car tunnel, ring tunnel, and chamber continuous kilns used in the heavy clay and refractories industries. The work has been carried out in close co-operation with the British Refractories Research Association, and the codes have been largely based on the methods of testing used by the Association. The British Standards Codes —the main object of which is to give an indication, to those carrying out such tests, of the methods which should be adopted and the data which should be obtained—have each been so drafted, depending upon the type of plant under consideration, as to evaluate efficiency, performance and output. Each code has been made as comprehensive as practicable, having regard to the special conditions in the industry concerned, but excludes reference to data which are not essential to a general valuation of the behaviour of the plant. Copies of B.S. 1081 may be obtained from the Institution, 28 Victoria Street, S.W.1, price 11s. post free.

General News

From Week to Week

The Petroleum Board warns smokers that the coloured pool petrol now being distributed contains lead and, therefore, should not be used in petrol lighters.

A warning that some property may become almost worthless through dry rot by the time the war ends is issued by the D.S.I.R. A number of serious cases of dry rot directly attributable to war conditions has come to the notice of the Forest Products Research Laboratory.

During 1942 men and women employees of more than 14,000 firms and organisations in England and Wales became contributing members of the Red Cross Penny-a-Week Fund. To-day, the workers of 41,500 firms are contributing a total of approximately £30,000 a week in pennies.

Traces of lead, tin, and silver have been determined in whole wheat flour, bran, and beeswing, by N. L. Kent (*J.S.C.I.*, 1942, *61*, 12. 183), by spectrographic analysis, using the copper arc. In most varieties of wheat all three metals were concentrated in the outer layers of the berry.

Although more phosphates are likely to be shipped to this country from North Africa, the total available will not necessarily increase, as imports from America may have to be reduced. The Ministry of Agriculture, therefore, is urging farmers to obtain basic slag where they can, in order to "make sure of phosphates."

The Scottish Co-operative Wholesale Society has indicated that it plans to enter the plastics industry immediately after the war. In reply to a request from the Co-operative Joint Auxiliary Council that the English and Scottish bodies should jointly investigate this field, it was stated that the S.C.W.S. had plans ready for development providing a source of added competition to makers already in the field whose products have so far enjoyed a monopoly of the co-operative market.

Last month, at the London works of Sternol, Ltd., lubricating oil manufacturers, a pleasant ceremony occurred, when the managing director, on behalf of the company, presented long service certificates to men who had been in the company's employ for 20 years or more. An extra Christmas monetary gift and a grant of a permanent addition to the standard wages was added in each case. The chief foreman, on behalf of the men, expressed appreciation of the company's action and thanked the managing director, at the same time congratulating him on having completed 50 years with the company.

The Iron and Steel Control announces that "6-6" quality high speed steel will no longer be manufactured. It will be replaced by molybdenum "4-6" high speed steel. This lowering of specification has been made possible by improved methods and the increased use of vanadium. The new steel will give equal performance and requires the same hardening treatment.

Sir Charles Darwin, scientific adviser to the Army Council, told the Institution of Civil Engineers in London last Tuesday that the greatest strength so far achieved for metals is only about a hundredth part of the strength theoretically possible. If the crystalline structure of metals were fully understood and capable of being completely controlled, the extreme limit of strength might be achieved.

The Dublin briquetting plant of the Great Southern Railway is scheduled to begin operations immediately. The plant is expected to produce 100 tons of briquettes a day from a combination of peat, timber, duff, smoke-box ash, and a proportion of Irish coal from Athy and Rossmore. The company's briquette plant at Inchicore now produces about 20 per cent. of the total quantity of fuel used by the railways of Eire.

The Larbert and Airth district of the Stirlingshire County Council has made a bid to develop the chemical and allied industries in the Larbert area after the war by staking its claim now. In reply to an inquiry by the Secretary of State for Scotland as to post-war possibilities, the area has indicated a desire for chemical and light engineering development in preference to other types of industry. Coal by-products are also regarded as being a suitable industry for the area.

Foreign News

A company has been formed in Colon, Panama, for the production of carbonic acid gas, according to trade reports. The capital of the concern is reported to be $350,000.

Authorisation has been granted for the erection of a new plant in Spain for the production of copper oxychloride, according to trade reports. This material is used by the Spanish paint industry.

Italy is reported to be sending a large proportion of its mercury output to Germany to be manufactured into fulminate and other compounds needed in the manufacture of explosives.

Completion of twelve new factories for the production of synthetic petrol and rubber in Eastern Germany, where the authorites hope they will escape the R.A.F., was reported by the German radio last week.

A new plant at Alfredshem, near Ornskoldsvik, Northern Sweden, is expected to yield 200 metric tons of thiokol a year as a by-product of wood-pulp manufacture. Present production is stated to be 100 kg. per day.

Over 50,000 workers will be transported hundreds of miles to the Amazon Valley within the next three months in an effort to double Brazil's production of rubber, states an Associated Press of America dispatch from Belem, quoted by Reuter.

A South African paint company recently patented a new enamelling process, according to *Foreign Commerce Weekly*. Vermiculite from the Transvaal is used to secure special colouring and metallic effects, and enamel made with processed vermiculite is said to have three times as much impact resistance as ordinary enamel.

Extended usage of the asphalt deposits of the Gard department (South France) is being investigated, with a view to developing them as a source of liquid hydrocarbons for fuel. So far the entire output, and that from only a part of the deposit, has been used for road-tar, but the composition (which includes 9.8 per cent. bitumen) is similar to the deposits at Ragusa (Sicily), now exploited for fuel under the direction of the Italian Government.

Forthcoming Events

The annual general meeting of the **Wholesale Drug Trade Association** will be held at the Holborn Restaurant (Caledonian Salon), on **January 19,** at 2.30 p.m.

At a meeting of the **Royal Society of Arts,** John Adam Street, Adelphi, W.C.2, to be held at 1.45 p.m., on **January 20,** Professor W. E. S. Turner will speak on "New Uses for Glass."

A lecture on "Fuel Economy and the Chemist" will be delivered to the **Chemical Society,** the **Institute of Chemistry,** the **Society of Chemical Industry,** and the **Institute of Fuel,** by Dr. E. W. Smith, at 5.30 p.m., on **January 21.** The meeting will take place at the University Chemical Department, Woodland Road, Bristol.

The **Chemical Society** will meet at 2.30 p.m., on **January 21,** at Burlington House, Piccadilly, W.1, for the reading of two papers. The first, by Mr. I. Dostrovsky and Dr. E. D. Hughes, will be on "Substitution Reactions of Neopentyl Halides"; the second will concern "The Mechanism of the Thermal Decomposition of Diacyl Peroxides in Solution in Organic Solvents," by Dr. A. E. Oxford.

A meeting of the **Institute of Fuel,** jointly with the **Institution of Electrical Engineers,** at Savoy Place, Victoria Embankment, W.C.2, will be held, at 5.30 p.m., on **January 22,** when a paper entitled "Boiler House Measurement and Control for Efficient Fuel Utilisation" will be presented by Messrs. G. H. Barker and A. L. Hancock.

A meeting of the Glasgow sections of the **Society of Chemical Industry,** the **Chemical Society,** and the **Institute of Chemistry,** will be held at the Royal Technical College, Glasgow, at 7 p.m., on **January 23,** when Dr. A. N. Currie will give a lecture on "Dermatitis."

There will be a meeting of the **Electro-depositors' Technical Society** jointly with the **Institution of Electrical Engineers,** at the Headquarters of the Institution, Savoy Place, Victoria Embankment, W.C.2, at 5.30 p.m., on **January 25.** A discussion on "Electric Power in Plating Plants," will be opened by Dr. J. Kronsbein.

The **Institute of Fuel** will meet at 2.30 p.m., on **January 29,** at the Geological Society's rooms, Burlington House, Piccadilly, W.1, when a paper on "Fuel Economy in Connection with Shell Boilers" will be presented by Mr. S. N. Duguid.

A Jubilee Memorial lecture of the **Society of Chemical Industry** will be given by Dr. W. H. J. Vernon, at Sheffield University, on **January 30,** at 2.30 p.m. He will speak on "The Corrosion of Metals in Air."

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *— followed by the date of the Summary, but such total may have been reduced.)

DAVEY, PAXMAN AND CO., LTD. (formerly Davey, Paxman and Co. (Colchester), Ltd.), engineers. (M., 16/1/43.) December 21, £2000 charge, to Colchester Permanent Benefit Building Society; charged on 15 to 23 St. Leonards Road, Colchester. *£56,980. August 7, 1942.

Satisfaction

ORCENE CO., LTD., Warwick, chemical manufacturers. (M.S., 16/1/43.) Satisfaction, December 24, of debenture registered July 3, 1940.

Companies Winding-up Voluntarily

The following companies were wound up voluntarily by special resolution at ex-

traordinary general meetings held at the offices of Imperial Chemical Industries, Ltd., the Hall, Welwyn, Hertfordshire, on December 31 (C.W.U.V., 16/1/43): THE PATENT ELECTRIC SHOT-FIRING CO., LTD.; BICKFORD, SMITH, AND CO., LTD.; BRITISH WESTFALITE, LTD.; CURTIS'S AND HARVEY, LTD; NORTHERN SABULITE EXPLOSIVES CO., LTD.; and ROBURITE AND AMMONAL, LTD. For the above-named companies A. W. Louttit, of I.C.I. (Explosives), Ltd., Nobel House, Stevenston, Ayrshire, was appointed liquidator. G. Norton, of I.C.I. Metals, Ltd., was appointed liquidator for the undermentioned companies: ELLIOTT'S METAL CO., LTD.; JOHN MARSTON, LTD.; ALLEN EVERITT AND SONS, LTD.; JOHN BIBBY, SONS AND CO. (GARSTON), LTD.; BRITISH COPPER MANUFACTURERS, LTD.; and the BROUGHTON COPPER CO., LTD. The voluntary winding-up of I.C.I. (SALT), LTD., I.C.I. (REXINE), LTD., and ALFLOC, LTD., has already been announced

Company News

British Celanese, Ltd., announce a net profit for the year to June 27 last of £403,495 (£187,257)

British Industrial Plastics, Ltd., announce a net profit of £21,424 (£15,989), for the year ended September 30, and have declared an ordinary dividend of 8 per cent. (6 per cent.). Forward, £6698 (£6288).

Dussek Brothers, Ltd., announce a net profit of £17,682 (£15,219), and a final dividend of 8½ per cent., making 12½ per cent. for the year (same).

Orcene Company, Ltd., Victoria Street, Warwick, have increased their nominal capital by the addition of £2000, in £1 shares, beyond the registered capital of £5000.

The directors of the **Midland Bank, Ltd.,** report a net profit, for 1942, of £1,997,132 (£1, 969,288), and recommend a dividend for the half-year ended Decembr 31, 1942, of 8 per cent., payable February 1, making 16 per cent. (same).

New Companies Registered

Burnett-Bels and Co., Ltd. (22,259).—Registered in Edinburgh as a private company. Capital: £500 in 500 shares of £1 each. Electric oxy-acetylene and general welders, workers in iron and steel, etc. Directors: A. H. D. Burnett, 28 Auldgirth Road, Glasgow; R. L. Douglas.

Cuprex, Ltd. (378,191).—Private company. Capital: £1000 in 1000 shares of £1 each. Smelters, refiners, manufacturers and mixers of metals and alloys, heat-treaters, metallurgists, chemists, analysts, engineers, etc. Subscribers: A. Astley; J. H. Moore. Registered office: 120 Moorgate Street, E.C.2.

Gremlin Products, Ltd. (378,154).—Private company. Capital: £100 in 100 shares of £1 each. Manufacturers of and dealers in chemical and allied substances, dyestuffs, plastic substances, synthetic resins, fertilisers, scientific apparatus and materials, etc. Subscribers: C. H. Polley, A. D. Poulter. Solicitors: Arthur Blackman, Hailey and Co., Capel House, E.C.2.

British Plastoids Company, Ltd. (378,036).—Private company. Capital: £5000 in 5000 shares of £1 each. To acquire the business of a manufacturer of plastics, synthetics and colloidal products carried on by A. E. Bowley at 9 Wellington Circus, Nottingham, as the "British Plastoids," and to carry on the same and the business of manufacturers of and dealers in paints, varnishes, etc. Directors: G. G. Proctor and A. E. Bowley, 9 Wellington Circus, Nottingham.

Carbide Distributing Agency, Ltd. (378,168).—Private company. Capital: £100 in 200 shares of 10s. each. To arrange for the supply and distribution of carbide of calcium, and such other products as may be agreed with the Ministry of Supply in the U.K. Directors: H. E. Baker; A. Cochenet; E. R. Hestcombe; A. G. C. Lucas; A. J. McMahon; F. W. Summerfield; E. W. D. Tennant; and W. W. Watt. Solicitors: Simpson, North, Harley and Co., 21 Surrey Street, W.C.2.

Transformer Steels, Ltd. (378,226).—Private company. Capital: £150,000 in £1 shares. Manufacturers, producers, importers and exporters of and dealers in metals and alloys, metallurgists, metal workers, chemists, engineers and contractors, manufacturers of and dealers in cables, conductors and insulating materials, etc. First directors: Sir Geoffrey R. Clarke (representing Telegraph Construction and Maintenance Co., Ltd.); G. R. Sankey (representing Joseph Sankey and Sons, Ltd.); E. H. Armitage (representing Brown Bayley's Steel Works, Ltd.). Each of the above companies is entitled to one representative on the board while holding at least three-tenths of the issued shares. Solicitors: Bircham and Co., Winchester House Old Broad Street, E.C.2.

Chemical and Allied Stocks and Shares

IN the early part of the week the volume of Stock Exchange business showed considerable expansion, and in most sections values recorded further gains on balance, although easier market conditions developed subsequently. In accordance with the general trend, securities of chemical and kindred companies showed further gains. At

37s. 10½d. Imperial Chemical were 9d. above the level ruling a week ago, while the 7 per cent. preference units were 35s. 3d. The view prevails that there seem reasonable possibilities of the I.C.I. dividend remaining on an 8 per cent. basis. Borax Consolidated at 35s. were 6d. better on balance, sentiment having also been aided by hopes that the dividend (7½ per cent.) may be maintained. Although as in many other instances, best prices made in the past few days were not fully held, the units of the Distillers Co. were better on balance at 87s. 9d., compared with 86s. British Oxygen at 72s. showed a small improvement, and British Aluminium at 49s. 6d. were virtually the same as a week ago. There was a better tendency in British Match shares, which were 6d. higher at 38s. Elsewhere, General Refractories 10s. shares improved 10½d. to 12s. 9d. there being talk in the market of possibilities of an improved dividend payment. In other directions, Amalgamated Metal eased to 17s. 6d., but Allied Ironfounders were favoured and moved up 1s. to 44s. 6d.

Greeff Chemicals Holdings 5s. units were better on realisation of the favourable yield on the basis of last year's dividend, and changed hands at the higher level of 7s. There was a tendency to higher prices in shares of companies connected with plastics, Lacrinoid Products being dealt in around 4s. 7½d., British Industrial Plastics around 5s. 1½d., Erinoid up to 11s. 3d., and Catalin around 3s. 6d., while dealings in Thomas De La Rue ranged up to 91s. 10½d. British Celanese were active at higher prices on the large increase in profits for the financial year ended June 30 last. Courtaulds were higher at 47s., but movements in most other textile shares showed small declines on balance. B. Laporte recorded a good gain, and changed hands up to 76s. 9d. Monsanto Chemicals 5½ per cent. preference were again 22s. 6d. Fisons remained at 41s. awaiting the financial results, and W. J. Bush ordinary were again very firmly held with the quotation at 50s. Elsewhere, Goodlass Wall maintained their recent improvement, dealings in these 10s. shares having been recorded up to 13s. 1½d. at the time of writing. At 27s. 6d. British Plaster Board 5s. ordinary were unchanged, while Associated Cement were 57s. 6d.

Although "ex" the maintained dividend, Nairn & Greenwich were higher, having in fact moved up from 55s. to 57s. 6d. on the good impression created by the results for the past year's working. Barry & Staines showed further improvement, being 38s. 9d. at the time of writing, compared with 37s. a week ago. Moreover, in other directions, Wall Paper Manufacturers deferred units recorded a further rise from 33s. 6d. to 36s. Turner & Newall, which remained in favour on consideration of the recently-issued results, were 74s. 3d., compared with 72s. 6d. a week ago. Moreover, Murex rose further from 105s. to 106s. 3d., and Birmid Industries were higher at 80s. Burt Boulton were around 18s. 6d., Lawes Chemical 8s. 9d., and British Drug Houses 23s. 6d. Boots Drug 5s. ordinary had a firm appearance at 39s. Sangers were higher at 20s., as were Timothy Whites 26s. Among other issues, Tube Investments rose to 92s. 3d., Stewarts & Lloyds to 52s. 3d., and Staveley ordinary were 30s. United Steel were 26s. 4½d., and Dorman Long 22s. 4½d., while Richard Thomas 6s. 8d. ordinary were quoted at 9s. In other directions British Glues & Chemicals 4s. ordinary remained firm at 7s. 6d. Cellon 5s. shares were again around 17s. 6d. An improvement from 33s. 9d. to 34s. 7½d. was recorded in Lever & Unilever, and British Oil & Cake preferred ordinary rose to 48s. At 35s. 9d. Dunlop Rubber lost part of an earlier rise. "Shell," Burmah Oil, and other leading oil shares showed further gains on balance.

British Chemical Prices

Market Reports

SATISFACTORY trading conditions are reported from nearly all sections of the general chemicals market with a fair weight of fresh inquiry in several directions. Deliveries against existing contracts appear to be well up to schedule and the price position throughout the market is steady, with a firm undertone. In the soda products section a fair amount of inquiry is in evidence for bichromate of soda and caustic soda, while bicarbonate of soda, Glauber salt and salt-cake are in good call. Among the potash chemicals offers of caustic potash and bichromate of potash are being promptly taken up. A tight supply position continues to be reported for yellow prussiate of potash, while permanganate of potash is a good market. White powdered arsenic is an active section and values are strong. A steady demand is reported for red and white leads, which continue on a firm basis, and a good inquiry is reported for both tin oxide and zinc oxide. Activity in the coal-tar products market has been fairly well spread over most sections, with cresylic acid and carbolic acid crystals in good demand.

MANCHESTER.—A fair amount of inquiry has been in evidence on the Manchester chemical market during the past week, mainly in connection with the "heavies," and moderate additions to order-books have been reported. For the most part makers are already carrying substantial contracts and these are being drawn against steadily. With regard to prices, these are maintained on a steady to firm basis. Among the tar products the light distillates generally are

moving steadily into consumption and there is a brisk demand also for creosote oils and crude tar.

GLASGOW.—Business in the Scottish heavy chemical trade since the beginning of this year has been rather quiet for home business. Export trade still remains rather difficult. Prices are still very firm and in some cases there has been an advance since the beginning of the year.

Price Changes

Pitch.—Medium, soft, 45s. to 55s. per ton, f.o.b. MANCHESTER: 46s. per ton, at works.

Pyridine.—90/140°, 18s. per gal.; 90/160°, 13s. to 14s. MANCHESTER: 14s. to 18s. 6d. per gal.

WEEK-END COURSE FOR INDUSTRIAL MEDICAL OFFICERS.

A WEEK-END Course on Factory Medical Services and Industrial Diseases will be held at the London School of Hygiene and Tropical Medicine, Gower Street, W.C.1, on Saturday and Sunday, February 27th and 28th, 1943. The Course will be a practical one and primarily for Works Medical Officers. Fee One Guinea. Apply to the SECRETARY for further information.

HORIZONTAL "U" TROUGH MIXERS, up to 48 in. long. Spiral, Ribbon or Paddle Blades. Enquiries invited from those on Essential Work. WINKWORTH MACHINERY, 65 High Street, Staines.

100 REBUILT Hydro Extractors by all leading makers from 18 in. upwards with countershafts attached and safety covers. Jacketed Steam Pans, various sizes. List on request. Seen at Randalls, Arundel Terrace, Barnes. Telephone: Riverside 2436.

1000 STRONG NEW WATERPROOF APRONS. To-day's value 5s. each. Clearing at 30s. dozen. Also large quantity Filter Cloths, cheap. Wilsons, Springfield Mills, Preston, Lancs. Phone 2198.

CHARCOAL, ANIMAL, and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps ground and granulated; established 1830; contractors to H.M. Government.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams, "Hill-Jones, Bochurch, London." Telephone: 3285 East.

HYDRAULIC TUBING, 1 in., large quantity, secondhand, new condition, also limited quantities other sizes and fittings. Hydraulic Valves, new, various types against requirements. Thompson & Son (Millwall), Ltd., Cuba Street, Millwall, London, E.14. East 1844.

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ADVERTISER requires a Powder Filling Machine suitable for filling packets up to half ounce in weight, or would be interested in hiring a machine. Send fullest details to Box No. 2098, THE CHEMICAL AGE, 154 Fleet Street, London, E.C.4.

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1941, October 4th and 25th.
1941, November 1st, 8th, 15th, 22nd and 29th.
1942, January 3rd, 10th and 17th.
1942, February 7th and 21st.
1942, May 30th.

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GRINDING of every description of chemical and other materials for the trade with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Hill-Jones, Bochurch, London." Telephone: 3285 East.

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WORKING NOTICE

THE Proprietors of the Patent No. 514,979 for Deodorant Powder are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to Haseltine Lake & Co., 28 Southampton Buildings, Chancery Lane, London, W.C.2.

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